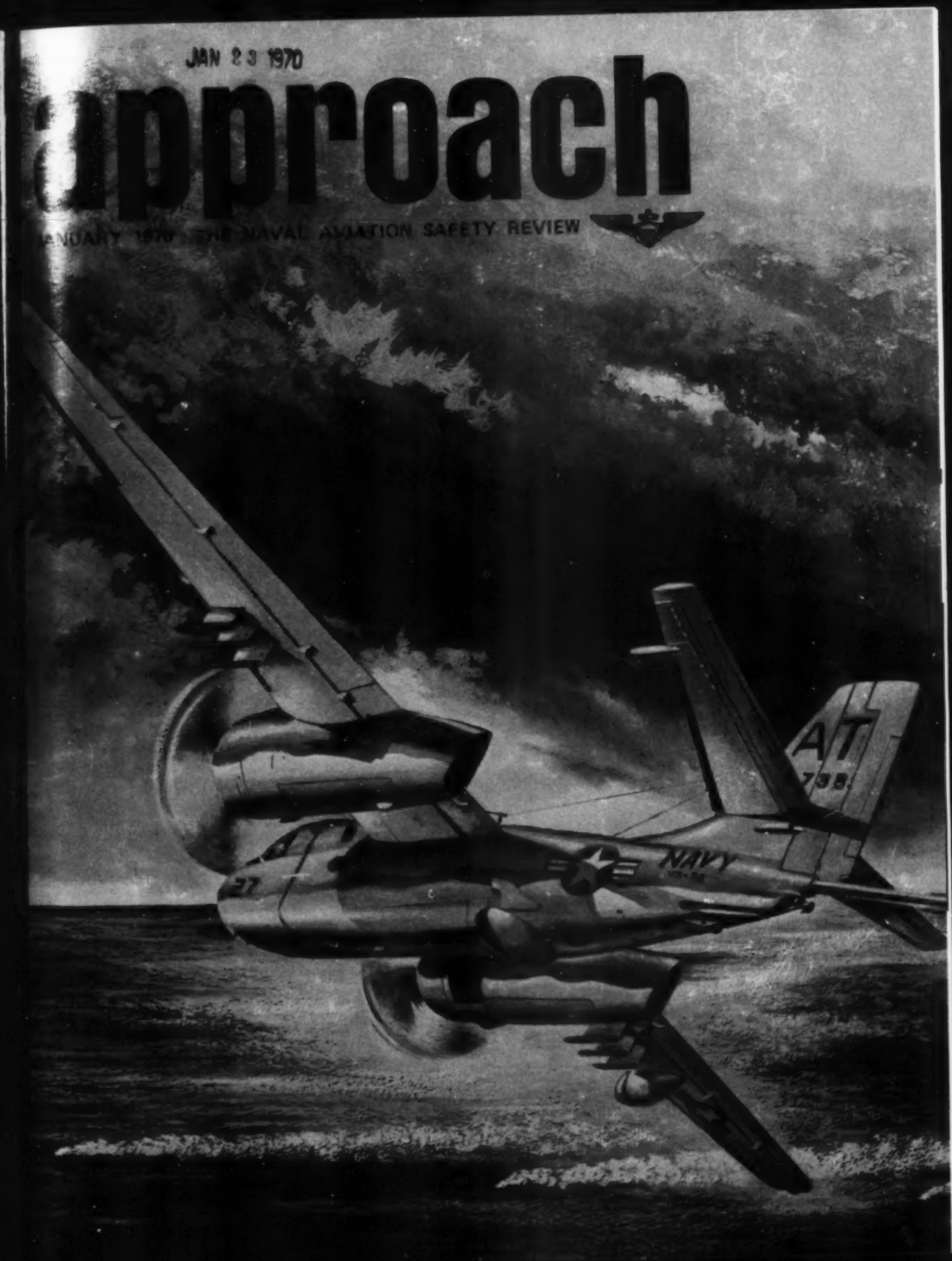
JAN 23 1970

Approach

JANUARY 1970 THE NAVAL AVIATION SAFETY REVIEW

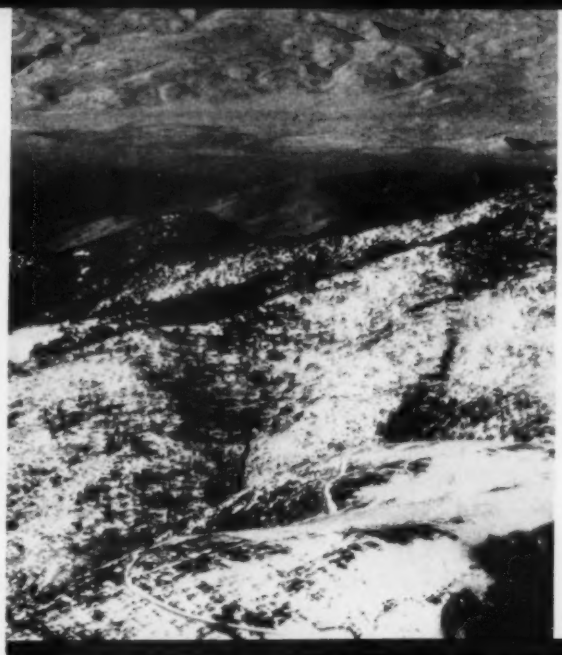


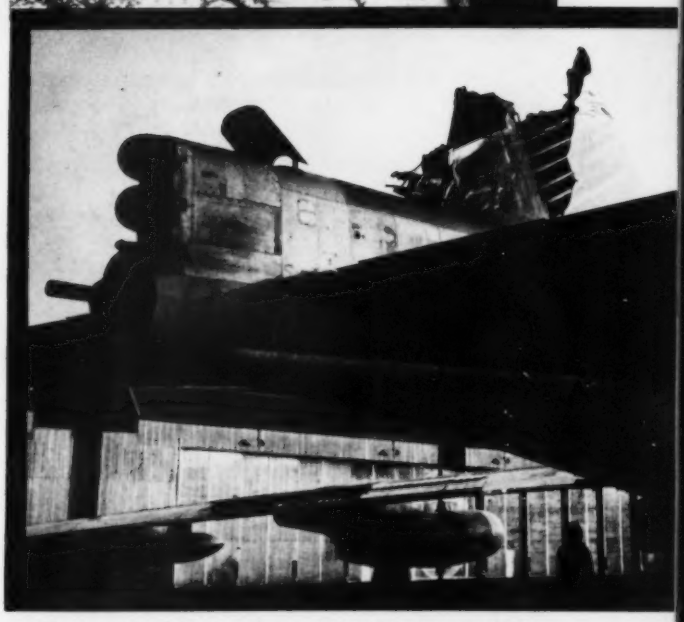
MOUNTAIN FLYING

SOME years ago the Air Force conducted a series of turbulence tests along the east side of the Rocky Mountains in Century-series fighters. The pilots reported that it was not unusual to experience gust loadings measured at 5 to 7G. The flights were flown at low level altitudes, throughout the day, along the lee side of the mountains. To illustrate the violence involved, one pilot, *although tightly strapped in*, was lifted off his seat and thrown forward enough so that his buttocks hit the stick when he came down. The pilots engaged in the project reported that their bodies and heads were banged around the cockpits by the force of the turbulence, that they could not talk coherently on the radio when in severe turbulence and in one instance the ejection seat handle of an aircraft was partly raised from its detent by an extremely violent downward gust.

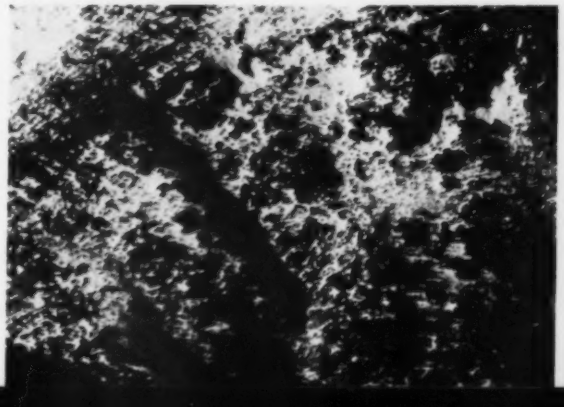
In the incidents described above the pilots were *intentionally* flying in regions of *expected* turbulence, they were *prepared*, they were highly *experienced* and were flying aircraft that are *designed* to withstand high G loads. Now consider a case where most of the factors remained the same with the exception of aircraft design. Similar crew qualifications existed, the same tracks were being flown at the same low levels. The aircraft, a multi-engine jet bomber, was on an authorized turbulence test flight and was flying along in relatively smooth air. In a 10 second period of time, things really turned to worms. The first sign of trouble occurred when the crew felt something like a single sharp blow to the aircraft followed rapidly by several more blows. The plane began an almost instantaneous rapid left roll and steep nose pitch up with yaw to the right. The aircraft did not respond to any control inputs. The pilots repeatedly tried to turn right (away from the mountains) but were helpless due to the grip of the mountain wave. Finally they were able to regain some semblance of control and, despite damage to the aircraft shown in the photograph, were able to land it successfully. The bomber, unlike the fighters, was not strong enough to withstand stresses imposed by severe turbulence.

Many aircraft which have crashed in mountainous terrain for "causes unknown" could easily have broken up in severe turbulence while airborne or, caught in the grips of mountain waves, been slammed into mountainsides. The insidious fact about these destructive forces is that two aircraft within minutes of each other in the same area and at the same altitude may not experience the same degree of turbulence. One aircraft can be thrown out of control while another may fly through the area without any appreciable difficulty. For example, two transports were cleared to take off, about 10 minutes apart, from an airport in the eastern Mediterranean one night. Both were westbound and





The crewmen of this aircraft were lucky! They returned safely even though the plane lost its entire vertical stabilizer in a vicious mountain wave.



A sure sign that a mountain wave exists and that extreme turbulence will be encountered in the clouds.

filed for the same route. One, except for a little rough air over the mountains, experienced nothing unusual. The second one was not as lucky. The highest peak in the general area was about 7800 feet, so the pilot was cleared to 10,000 feet before crossing the range, as the first pilot had been. After the second pilot leveled off at 10,000 feet and set cruise power, he noticed his airspeed was decreasing. As he disengaged the auto pilot and took the controls, everything in his lap including a small clipboard, literally jumped toward the overhead and remained suspended at eye level for approximately two seconds. He called for climb power but his airspeed continued to decrease. The aircraft entered a lenticular-looking cloud formation (see photo) and extreme turbulence was encountered. Full power was set but the big transport continued its descent. By this time both pilots were on the controls attempting to fly attitude. The vertical speed indicator held constant at 2500 feet per minute DOWN. At about 8000 feet the descent stopped! Shortly thereafter the aircraft began a very sharp climb and, even with descent power, the plane (now indicating 4000 feet per minute UP) climbed to 10,000 feet in about 30 seconds. The crew never knew how near they came to the 7800 foot peak but it had to be close! One does not have to stretch the imagination too much to guess that if they had crashed, the investigators would probably have attributed the accident to cause(s) unknown. This aircraft, like the bomber, had been caught in the grip of a well-developed mountain wave and, despite full power and 2200 feet altitude above the terrain, almost failed to recover.

Meteorological Conditions

Certain hazards of mountain flying will be discussed and should be of interest to anyone who may be

WIND FLOW OVER AND AROUND PEAKS

1. Null area usually found on leeward side at crest of slope.
2. In very strong wind conditions, and/or on very steep slopes. Turbulence will be found on the leeward side of the slope in clear air.
3. Updrafts will extend above the surface further than the turbulence, depending on wind speed.

Fig. 1

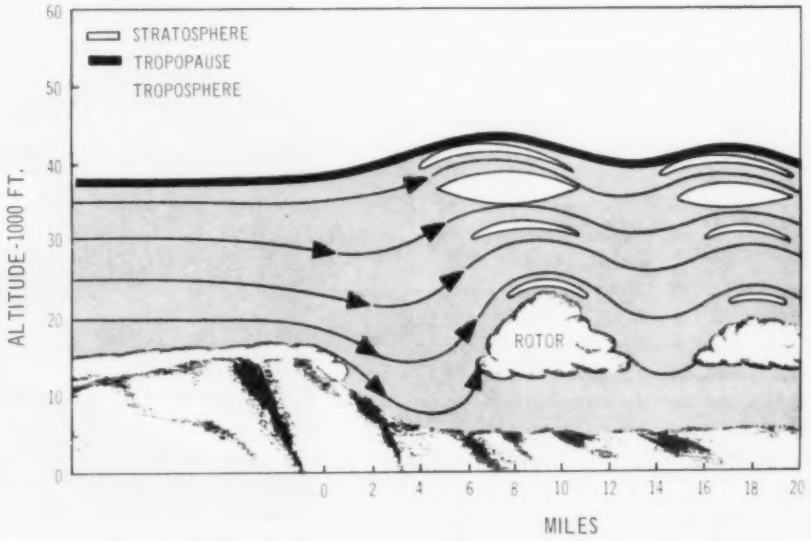
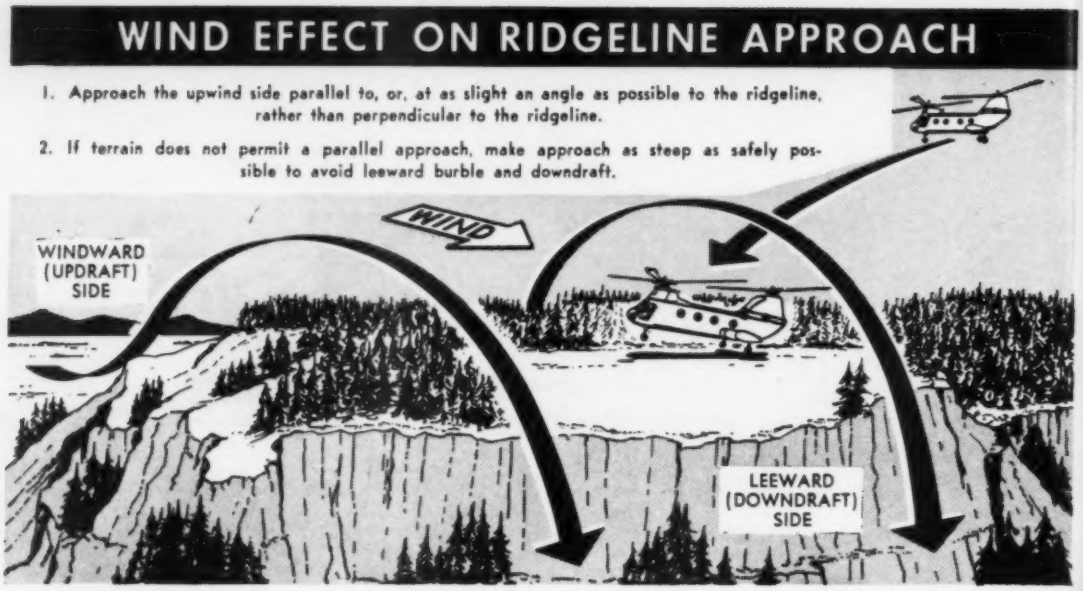


Fig. 2

required to fly at low levels in or around mountainous terrain. These hazards are mountain waves, turbulence, winds and clouds. A truism about mountain flying exists which bears repeating: meteorological conditions – wind, weather and turbulence – are constantly changing. The old hand, wise to the ways of nature's whims, expects the worst, allows plenty of extra margin and is pleased if conditions are not as bad as he anticipated.

Mountain Waves

A mountain wave may form when winds greater than 20 to 25 knots blow perpendicular to a ridge line. It usually will have a core of turbulence and can extend downwind many miles (up to 20) from a ridge. Typical mountain wave action is depicted in the two figures above. Fig. 1 illustrates the wave action in clear air. Fig. 2 shows the wave action with associated cloud formations. Using these illustrations, the conditions


WIND EFFECT ON RIDGELINE APPROACH
1. Approach the upwind side parallel to, or, at as slight an angle as possible to the ridgeline, rather than perpendicular to the ridgeline.
2. If terrain does not permit a parallel approach, make approach as steep as safely possible to avoid leeward burble and downdraft.
WIND
WINDWARD (UPDRAFT) SIDE
LEEWARD (DOWNDRAFT) SIDE

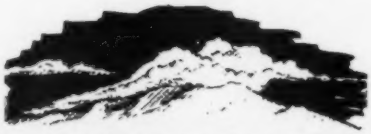
Preferred flight paths.

encountered by the aircraft previously mentioned become evident. Perhaps a good rule of thumb to remember when crossing ridge lines is to allow an additional 50 percent of the height of the ridge for a safe crossing altitude. (e.g. if the ridge line is 12,000 feet, cross at 18,000 feet or above.) Mountain wave action has been known to occur as high as 70,000 feet but this is unusual. (One story is told, possibly a bit salty, of a P-38 which gained 15,000 feet riding a strong mountain wave, with both "fans" feathered!) Mountain waves rise with gradually increasing velocity on the windward side of ridges and mountains. The speed of the wave reaches its maximum near the peak and then the wave breaks down as it flows over the peak, like the Niagara over the falls, into streams of downdrafts and then finally rises again, swirling and rotating.

Clouds

There are three distinct types of clouds which will warn any pilot of the presence of mountain waves.

- Cap clouds, the first type, hug the tops of ridges on the windward side and may flow with the air currents down the leeward side. These clouds may contain downdrafts measuring as much as 5000 fpm.
- Roll clouds form downwind on the lee side about the same level or a little higher than the peaks as the result of the ascending air and have a distinct whirling (rotary) motion.
- Lenticular clouds, the last of the three, are also distinctive in shape and form above the roll clouds (again



A cap or foehnwall cloud, severe downdrafts.

Typical mountain wave clouds seen from above.

This lenticular is ragged; expect turbulence.

on the lee side) and are extremely turbulent near their tops. The accompanying photographs illustrate these three particular types of clouds.

Turbulence

Most pilots have blundered into thunderstorms at one time or another (some have flown into them intentionally) and are familiar with the turbulence which is usually encountered. However, one pilot who was engaged in test work, both in thunderstorm penetrations and in mountain wave flying in a specially configured fighter, reported that the CAT (clear air turbulence) associated with mountain wave action is worse than thunderstorm turbulence. Years ago during a mountain wave test, a sailplane stressed to withstand 14G was torn apart during flight through a roll cloud. The pilot bailed out successfully and lived to tell about it! Aircraft which have been highly instrumented have routinely recorded turbulence (gusts) in the range of 100-120 fps (5 to 7G) and up to *triple* this figure on occasion.

Winds

Winds at high terrain elevations are rarely calm. Strong winds blow most of the time, usually in gusts, and from constantly shifting directions. This is due to peaks, ridges and passes which deflect wind flow. The lack of clues such as smoke, swaying trees and wind streaks on water make wind direction and velocity difficult to ascertain.

How Now Helicopters?

Flying helicopters in mountainous terrain is particularly treacherous at times and calls for special techniques. The number of helicopter accidents in mountainous areas caused solely by poor pilot technique indicates a general lack of knowledge and experience in this particular phase of flying on the part of most Navy and Marine Corps helicopter pilots. The difference between sea level and mountain flying in helos is like night and day – they are at opposite ends of the flight spectrum. The chopper pilot who frequently flies

Beware! Extreme turbulence awaits.

successfully and routinely in mountainous regions enjoys about the same prestige among other pilots as a PhD does among high school students. His knowledge and extra skills set him apart from his sea level compatriots. He survives because of his knowledge, planning, concentration, training and experience, and in particular the latter. Just as the tailhook pilot gains experience by making carrier landings the helicopter pilot gains experience in mountain flying by flying in the mountains. Forecasting winds and weather in the mountains is at best very difficult. The information which you get from Valley Airport about the conditions on Mountain Peak is general information only. If there is one thing you can be sure of, it is that conditions will be different "up there" when you arrive than they were "down there" when you took off. Winds around the tops of ridges are erratic, changing, swirling and unpredictable. The more rugged the terrain the harder it is to predict weather conditions. And, it usually is in the most rugged regions that downed aircraft searches are required. Few helo crews are ever lucky enough to find downed aircraft, or individuals who have ejected, out in the open on a half-way decent plateau.

Helicopter Pilot Techniques

For years helicopters, flown by experienced pilots, have been operated successfully at high altitudes. Many extraordinary mountain rescues have been made by helicopter pilots at altitudes in excess of 12,000 feet. However, these unusual feats of derring-do were performed by pilots who were familiar with the treacherous conditions present in mountain flying and were thoroughly prepared for their missions.

The NATOPS manual for most helicopter models contains all sorts of schematics, diagrams and recommended techniques concerning wave actions, wind flow patterns, preferred approach paths and general information for flight in the mountains. This is an excellent source of information and will give helo pilots sound knowledge on areas to avoid or areas which are preferred. Other important information, to which particular attention should be directed by anyone conducting search and rescue missions, carrying external loads or planning to land at high elevation LZs (landing zones) are the sections of NATOPS depicting HOGE and HIGE (hover out/in ground effect) information, density altitude determinations (caution: do not use pressure

Suitable emergency landing areas are almost nonexistent.

altitude), power required versus power available charts and gross weight curves. Seldom in sea level flying are all of these tables utilized but in mountain flying all of them *should* be used. Always be on the conservative side if any conditions or figures you require are not known. If you don't know your exact weight, add an extra 1000 or 2000 pounds. 'Tis far better to know that you can safely land or hover at 10,000 feet density altitude and find out that the density altitude was only 8500 feet than the opposite. If after all of your careful planning there is still some doubt, make two trips with a light load the first time, rather than one at or near max gross.

In this discussion thus far we have assumed that time permits advance planning for a specific high altitude mission before heading for the hills. Now, suppose that you are out on a training hop and you are directed to cover an emergency. Assuming that you have plenty of fuel, as you head for the mountains, you can begin an orderly review of those factors (using knowledge obtained by prior study) which will enter into the SAR (search and rescue) attempt. What is your weight? Some quick mental calculations will give this to you. What kind of day has it been? Hot, about standard, or cold? Now you have a pretty fair idea of the performance you are going to get out of your bird at altitude. If there is a choice, you know on which side of the ridge to commence the search and what general patterns of updrafts and downdrafts you are likely to encounter. You should immediately recall that at altitude your rotary wing machine will have to make like a fixed wing airplane in that you will have to maintain airspeed as well as rotor speed. Any semblance of power settling, if you get busy searching and allow the helicopter to get slow, and you will need all of the altitude you can get in order to recover. So while searching it will be necessary to have one eye looking over the terrain, one eye on the instruments in the cockpit, one eye always looking for an escape route if you get in trouble and one eye casting about for an emergency landing area for yourself. However, with two of you "up front" in most helos, and only four eyes needed, you can hack it! When you find whatever you are searching for, advise the nearest agency before even considering a landing or close inspection of an area. If a landing is to be made, make every effort to check the wind direction and estimate its velocity; plan your approach with an escape route to provide for a waveoff should one become necessary; make several fly-bys to examine the site for slopes and obstructions (a landing area in the mountains may look fairly flat only to turn out to be a slope of 20 or 25 degrees and that is not good) and also, while conducting fly-bys, make power checks to see if the power available is considerably more than the power required. Remember if you get down nicely you still need to have enough power to get back out and you may have one or two extra people aboard. On your final approach keep up your airspeed until over the LZ and remember if your turns begin to deteriorate abort, *abort*, ABORT! Get your RPM back up and try another approach. Altitude and airspeed are the only two factors which will help get you out of power settling and if you don't have both to spare, you are committed to a hard landing at least. Maybe, if you are lucky, someone else will get in to pick *you* up. Smooth handling of controls and shallow turns are important safety precautions to remember. Establish an attitude (never flat) and power setting which will remain constant during your approach. Always select and shoot for a spot in the LZ. A rate of descent of 200 to 300 fpm has many advantages: it will generally avoid the necessity of large control changes or power changes; it will make a precision approach to a spot easier; it will enable you to descend through drafts and turbulence with full control of the helo.

Summary

No one knows all there is to know about mountain flying but any pilot can learn enough, in advance, to enable him to fly in mountainous regions with a high degree of safety and success. The key to safe, routine mountain flying is experience and the gaining of experience must be preceded by knowledge.

- Know the variety of meteorological conditions prevalent in mountains.
- Know the preferred routes and approach paths around mountain tops.
- Know the performance figures and capabilities of your bird at all altitudes.
- Know the importance of both airspeed and rotor RPM at altitude.
- Know that caution and conservatism are important in the success of high altitude missions.

Erroneous pitot-static system indications caused by mountain waves will be the subject of a future article. – Ed. ◄

Bibliography:
In preparation of this article the author has borrowed freely from many previously published articles on the general subject.
APPROACH, Feb 1961, "Mountain Helicopter Flying"
APPROACH, Oct 1965, "Hills, Heights and Helos"
Mountain Flying Sense, Dept. of the Army, NW-00-80Q-62
AEROSPACE Safety, Jan 1965, "Mountain Wave"
AEROSPACE Safety, Apr 1965, "Low Down CAT"
AEROSPACE Safety, Apr 1967, "The Vicious Wind"
Airscoop, Mar 1966, "The Mountain Wave"
Combat Crew, Dec 1966, "Atmospheric Turbulence"
Article by Capt. A. R. Langford, 3500 PTW Reese AFB, "Something Missing"

This story is the result of an Anymouse submitted to APPROACH on a subject not frequently discussed. There are, however, some of us who might be truthfully referred to as

COUSIN WEAKEYES

NEVER in my 20-odd years of pedaling airplanes around the sky had I ever seen the old definition of naval aviation so clearly demonstrated. The brief moment of stark terror that suddenly emerged after hours of boredom very nearly put "Yours truly" (and my trusty crew) AOCP for what probably would have been an extended period of time. But enough of the probabilities – let's get down to "Wha' hoppened!" (And I might add, "How come?")

Now, I'm a right good-natured four striper with the standard thick log book, shiny-seated trousers and "reading glasses" that are frequently found to be in evidence at a great many of our shore installations around ConUS. I've done most of my airplane driving for the past several years in the trusty old "Gooney Bird" and, I must admit, under VFR conditions. But I've got mucho time in the clag in days gone by. So when I got homeplate weather one evening of 100 feet and one-fourth mile visibility, I didn't really go to GQ. I had been driving the 117 all over the east coast under absolutely beautiful weather conditions for seven hours and finally was getting home to find a small but thick fog bank had beat me there. As it turns out, I had my "reading specs" in my uniform coat hanging in the back of the airplane. But, so what – I really don't have that much trouble seeing things at a distance, even in the dusk.

The final controller picked us up at about nine miles, a happy 2000 feet VFR, and on course. I must admit that it was a little shocking when we were descended to 1200 feet and not only did the visibility go down to nothing because of fog, but it also suddenly got dark. The red lights in the gages were nice and bright, however, and things seemed to be well under control.

The GCA controller advised us of our position on final approach and requested that we cease

acknowledgment of further radio transmissions. He then announced that we were drifting right of centerline and called for a heading change that amounted to a 10 degree crab (or so I thought). At any rate, things were running smoothly, on glideslope, on centerline, when all of a sudden we were at minimums and breaking out – only to find the runway several hundred feet to our right. I might add that my transition from instruments to runway lights left me with eyeballs that weren't focusing on anything very well. I made an immediate right turn and dropped the nose of the "Gooney," and by the time my eyes started putting out good info, found myself to be halfway down the runway, 15 knots fast and still flying. The transition to landing was accomplished by pulling all the motor off and splat! with the main mounts. This finally occurred with something slightly less than 3000 feet of runway to go.

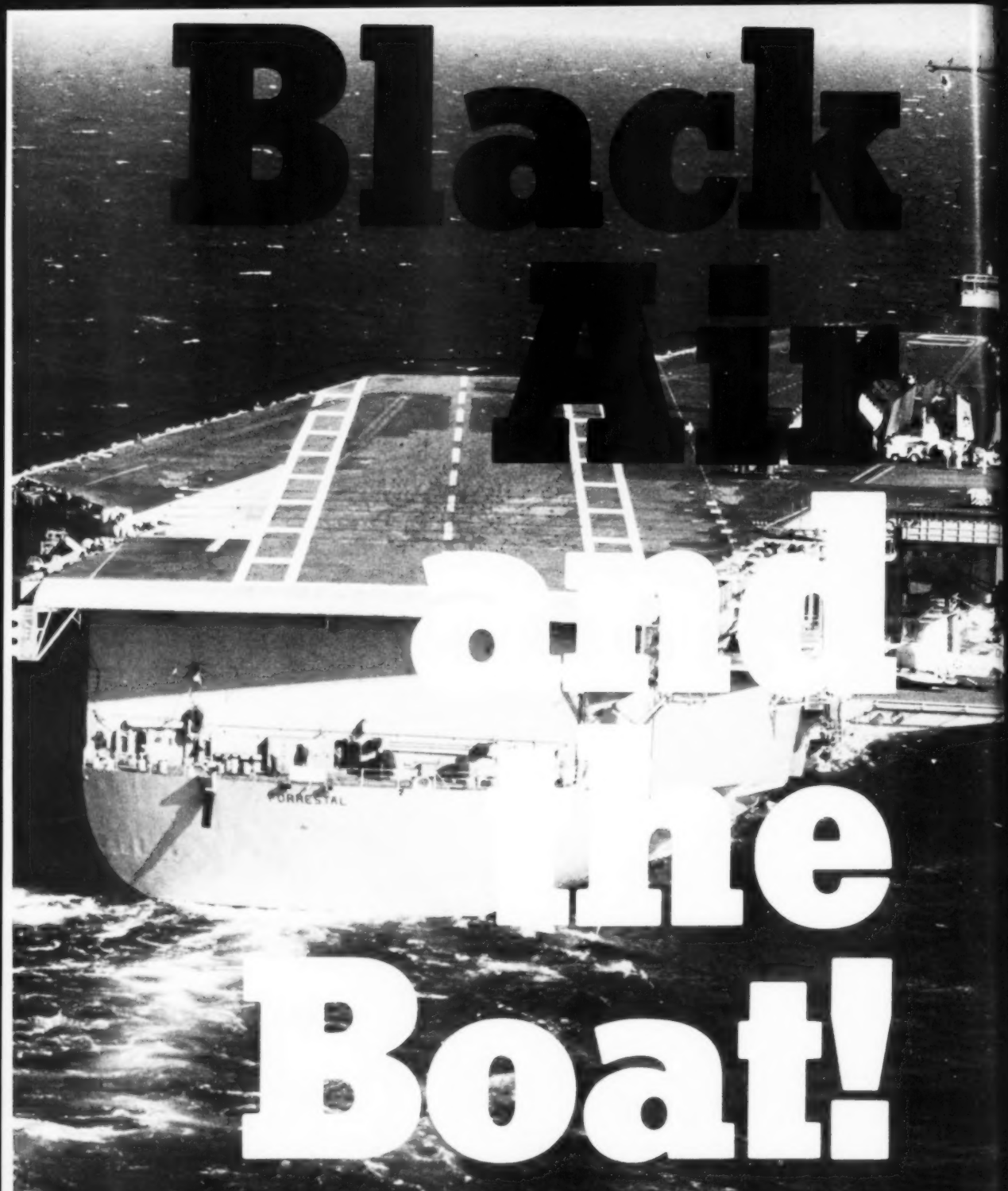
We-e-ell, I never saw red-hot brakes on a 117 before! In fact, I don't think the crash crew had either. And I also never saw an expression like the one my copilot was wearing! Luckily, no damage was done to the bird because I didn't really hit the fence – just leaned up against it – and grass stains never hurt tires anyhow. We got the bird back to the line OK and so much for that.

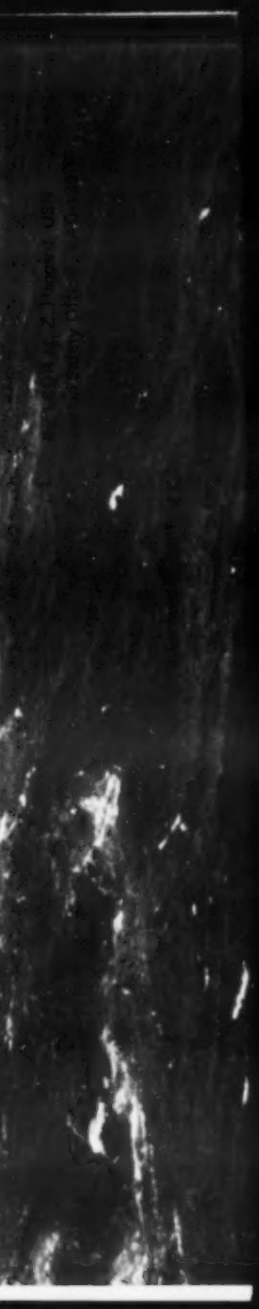
But really, after giving some thought the next day to all that had transpired, I reached several conclusions. I need the specs to hit a golf ball – probably ought to use them for hitting runways, too. And, after turning back eight pages of my log book before I could find an "A" type approach I figure maybe I need more practice more frequently than has been the case up to now. Four stripes and four log books do not the man make when he can't see the runway in time to land safely!

Amen! – Ed. ◄

or How to Terrify Copilots!

Black Air One Boat!





About the Article

The accompanying article discusses a proposal for the use of gimbaled searchlights to produce a visual "horizon" for night aircraft carrier operations. Specific proposals have been submitted to the Naval Air Engineering Center, Philadelphia and are now under evaluation. Our goal in presenting the article is not to prejudge the merits of these proposals but rather to stimulate interest in this important area of naval aviation operations. The author also has this goal in mind, as indicated by excerpts from his letter covering submission of the article. He writes:

"I hope to accomplish two purposes with the article. Everyone from CNO down reads APPROACH. I hope to spark an interest in the use of light beams and to spur their evaluation. I'm out here in WestPac now, milling around in the dark in a "*Whale*" and would like to see some improvement in flight deck lighting in time to get some use out of it.

"Secondly, there are some problem areas, primarily in the physical construction of existing lights used for the production of usable beams. I hope to solicit comments and ideas from engineering personnel or those with experience in lighting or optics."

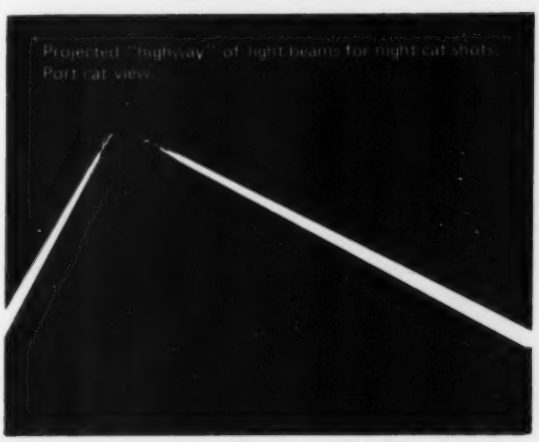
Editor

Would It Be Easier With Light Beams?

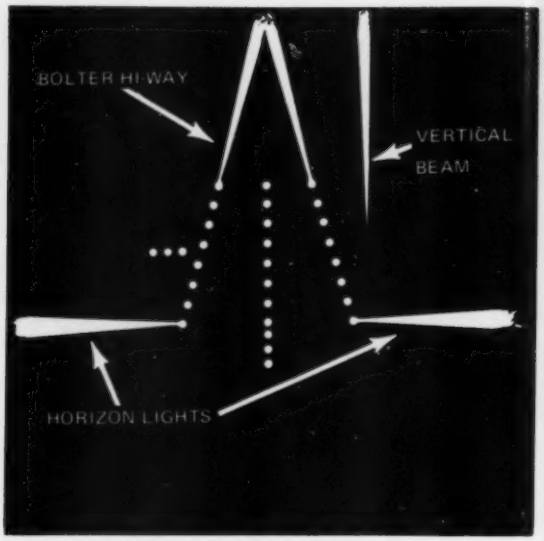
CARRIER aviation has come a long way since Eugene Ely got his first trap. The advent of heavier and more powerful aircraft led to development of catapults and hydraulic arresting machinery. The characteristics of high performance jet aircraft brought steam catapults, the angle deck and the mirror – thanks to the British. Profound changes to equipment and carrier operating techniques have generally come about after losses or failures have made the need for changes obvious. There is one other area long overdue for improvement – night carrier operations.

One of the most demanding and difficult facets of naval aviation is the night carrier launch and recovery. Almost every *Weekly Accident Summary* tells it again – "Ramp strike on night CCA . . . ," "Aircraft bingoed to beach after night ramp strike . . . insufficient fuel . . .ejected 20 miles . . . ," "Night CCA, radio and radar contact lost . . . " Why? Why are night carrier ops more demanding than daytime ops? To the carrier aviator it's a ridiculous question. It's dark out there, often with absolutely no horizon. He is faced with an instrument approach to minimums on every recovery with just bare seconds to make final visual corrections before touchdown. When he calls the "ball," he sees only the lens and three short rows of lights in a black void. Quite often he is experiencing vertigo at the time of transition, yet there is very little to give him an attitude reference outside of the cockpit during these critical few seconds. The radio maybe a conglomeration of staccato voice calls to other aircraft being controlled simultaneously. The characteristics of his aircraft and

Off the bow on a black night.



Carrier landing area from one-half mile in the groove with existing lighting.



Recommend horizontal and vertical lights as well as bolter "highway" similar to the one for cat shots. This as seen from one-half mile astern.

the arresting gear usually permit him only a minimum of fuel on board – in some cases just enough for a few passes before being diverted to a shore base. And finally, vertigo is experienced to a degree by all pilots during these operations and is considered a factor by almost every survivor of a night launch or recovery mishap.

For a relatively low cost, many of the problems of night carrier operations could possibly be eliminated. Have you ever been to a movie premiere or a county fair? Did you notice the distinct beams produced by the searchlights used to attract attention? This type of light could be installed on our carriers to produce visual aids for launches, recoveries and bolters.

If such lights were mounted on each side of the flight deck rounddown and directed horizontally (perpendicular to line of flight), they would produce an artifical visual horizon. Simple stabilized mounts could compensate for ship's roll and keep the beams parallel to the actual horizon. Mounted just below the bow and directed forward, two searchlights could provide the pilot a set of "rails" that would give a visual heading, attitude and altitude reference after the catapult shot. Gimbal mounts in this case would compensate for pitch, the ship's roll being insignificant here since the light beams would be projected straight forward. A similar set installed at the end of the angle deck would eliminate the "black hole" the pilot finds himself in on a dark night bolter. They would also extend the landing area light "lines" to produce an extended "runway" several miles long which would aid in the lineup problem.

An additional vertical beam could be utilized for a multiplicity of uses. Equipped with code shutters, it could be used for signaling aircraft with lost radios or during EmCon (electromagnetic radiation control) conditions. It could be a visual rendezvous point, holding fix and vertical "horizon" for aircraft in the general vicinity of the ship. If installed so as to be maneuverable, this beam could be used to establish a visible "radial" from the ship. For example, during carquals the beam could be set to point toward the bingo field. This would provide the pilot with the proper heading immediately, rather than his having to wait for the switch to departure control, and would be a cross check on his compass. Other uses could evolve, restricted only by the imagination of the ship and embarked air wing.

It is human nature to resist change so let's look at some possible objections.

"It would light up the carrier like a Christmas tree."

R-i-g-h-t! This is true! The days of running dark, however, are past. A carrier can be detected from much farther than the eye can see with the use of electronic surveillance equipment and radar. The current tacan/SPN-10 recoveries now in use produce electronic emissions that compromise the ship's position much more than searchlights could. If the world situation deteriorates to the point where a carrier is attacked, surely it will be with more finesse than just an "eyeball" raid. Very possibly the light system will actually improve the ship's security against sophisticated weapons systems. It is pure conjecture at this time, and provable

only by an extensive evaluation, but the light beams could produce sufficient visual references to allow carriers to conduct *Case One* recoveries at night and maintain complete EmCon conditions. CCA would be required only during adverse weather.

"Will a beam of light be visible?"

Definitely. But it takes a certain type of light. It must have a high intensity light source such as a carbon arc or gas flame and have a parabolic reflector. USS CORAL SEA recently evaluated its 24-inch searchlight as a visual landing aid. The beam produced was visible from a distance of 25 miles on a clear, dark night having 10 miles average visibility. Haze conditions only serve to intensify the beam due to the microscopic nuclei in the atmosphere. Although not evaluated at this time, the beams should show up well in light rain and fog. (In dense fog or heavy rain, the beams would probably be diffused and unusable.)

"The beams would be unusable in low overcast conditions."

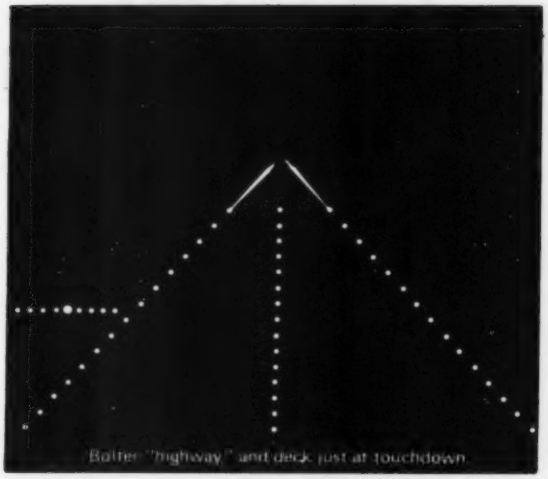
Not necessarily so! The 24-inch vertical searchlight beam was observed to "punch through" a 1500 foot cloud deck and still be usable as an attitude reference. If a thicker overcast is present the beam generally produces a white spot on top of the cloud deck that is usable as a holding fix, for example. If a low overcast is present, the pilot will have a very welcome visual "horizon" waiting for him on "breakout." Since the lights would be mounted at flight deck level they would still be prominent and undiffused as long as the overcast is above flight deck level.

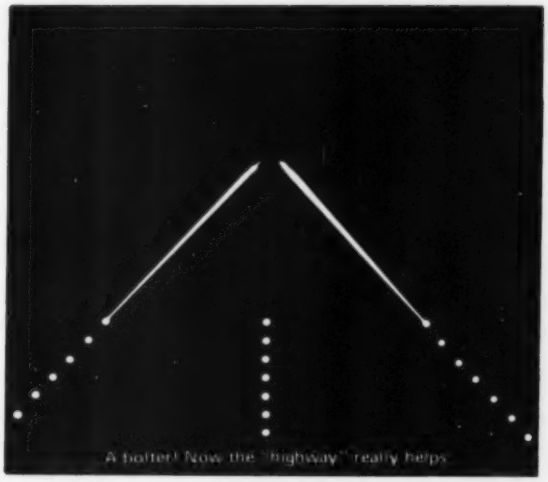
"The lights would blind the LSO and OOD."

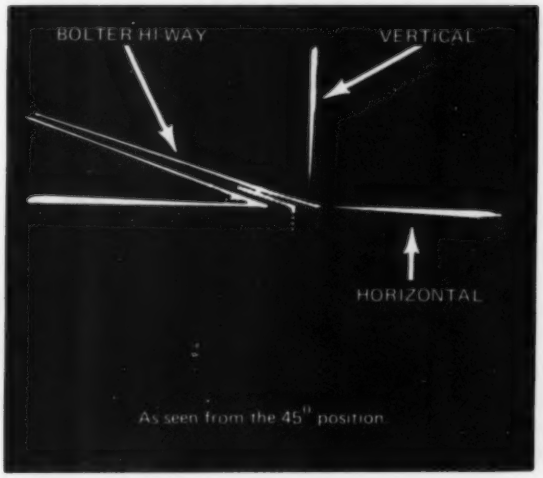
Not so! The beams of light are bright enough to be seen but not blinding unless the observer is looking directly into the light. The light itself would be hooded to protect the LSO and if a pilot is ever in a position to be blinded by looking directly into the light, he had better pull up – for he is very close to the water.

The only problem at this time seems to be in the physical construction of searchlights. They are relatively complicated and would require personnel at the lights to monitor their operations. A type of light is needed that will do the job, yet be controlled by Pri-Fly with simple off-on switches. Comments from lighting engineers or other persons knowledgeable in the field of lighting and optics are certainly solicited.

This is not to say that searchlights are the panacea for carrier night ops. No mechanical device will in itself replace the need for technique and skill. But this aviator's idea may represent a contribution to accident prevention. Have you got an idea along these lines? If you do, don't keep it a secret! **Speak up.** *– Ed.*







Short Snorts

When you become so good you're complacent, you aren't good enough.
Anon.

Neither Will A Bumblebee

A RECENT report received by NavSafeCen involving an attack aircraft accident begins with words to this effect – the aircraft incurred delta damage about 2315 during field mirror landing practice. The pilot was uninjured and no property damage resulted. There isn't anything startling about this introduction but it does set the stage for the rest of the report.

Short Hop

The flight lasted five minutes. The takeoff seemed normal until about 100 feet altitude when the pilot felt an unusual yaw and heard a cracking sound. The pilot checked his rudder trim but the ball was centered. However, he did see the master caution light and hydraulic pressure light illuminate and PC-2 pressure dropped to zero. He had extreme difficulty maintaining lateral control and also became concerned by an increasing angle-of-attack. The plane repeatedly attempted to roll to the right and each time the pilot required full left stick to stop the roll. The plane was nearly out of control around the roll axis. He blew his flaps and gear down and started a wide, easy right turn and told the tower his problems. *The tower requested a change to another channel and asked if he needed assistance.* (More about this later.) During his one and only circuit of the pattern his altitude varied from 400 feet to 900 feet. He received clearance to land but because of his control problems overshot his turn to final. However, after giving the tower a gear check he landed softly, slightly long and on centerline. The rollout was uneventful and when he slowed down enough he turned off the duty runway. While on the taxiway he lost his brakes and, after shutting down, was towed into the line.

Preflight

The pilot left the ready room at 2230 to sign the yellow sheet and man the aircraft, which was then being flown by another pilot. After the plane arrived the pilot made a walk-around inspection and manned the aircraft without shutting down. He did not go through any checks with a plane captain but taxied out, stopped spread his wings and waited while the crewmen ran through their checks. He then ran through the complete takeoff checklist with the exception of the canopy. Ground control was contacted and clearance to taxi to the runup spot and hold was given. There were four aircraft ahead of him waiting to take off. Since his fuel was just a little over 3000 pounds and he had been advised of a 10 minute delay, the pilot requested and was granted clearance to the fuel pits. While taxiing to the fuel pits he folded his wings and as he arrived a ground crewman approached his plane and put the downlocks on. While waiting his turn to enter the fuel pits the pilot switched to tower frequency and was advised the pattern was open. So he gave the signal to remove the downlocks and called ground control for taxi clearance back to the duty runway. Before he reached the runway he switched to tower frequency and was given takeoff clearance. He performed a cursory takeoff checklist – trim, ejection seat handle and canopy – took the

Aerodynamicists say he can't possibly fly but he doesn't know that – and flies anyhow.

runway and made his takeoff *with the wings folded.*

Retrospect

Just as aeroengineers maintain that our stubby-bodied, short-winged hymenopterous insects can't fly, they also maintain that this attack aircraft couldn't fly with its wings folded – but it did! In the broad daylight, many thousands of miles away from the scene and in a completely dispassionate atmosphere, analysis of this very unusual flight brought forth the following points for discussion:

- Tower personnel must be cautioned not to prejudge the seriousness of radio calls indicating trouble. It's far better for tower operators, when in good communications with a pilot in trouble, to clutter up the frequency a little than to request a change in channels and risk loss of communications or worse yet, compounding the trouble by adding the potential distraction of changing frequencies.
- Hot seating a plane is a procedure which, at best, should not be SOP. Aside from leaving the cockpit unmanned for a short period, the practice of hot seating eliminates the plane captain checks which, although not involved in this incident, are vital checks for these complex weapon systems.
- The habit pattern of the pilot was interrupted twice and he did not conduct even a cursory check of placarded items after taking the duty runway. The wing lock warning light appears as the second item on the panel mounted takeoff checklist.
- The wheels watch stationed near the duty runway observed the plane taxiing *toward* the duty runway with its wings folded but his attention was directed back to the approach pattern and he did not see the pilot takeoff.
- Whenever something better than a checklist for takeoffs is invented you will be one of the first to know.

Would You Believe

SOME guys will do anything to go flying! One summer day deep in the mountains of Vietnam a CH-47 was making a hookup to sling load a UH-1H back to base. As the CH-47 picked the "Huey" off the ground the crew informed the pilot that someone was in the cockpit of the "Huey." The aircraft was immediately lowered to the ground. The pilot of the CH-47 then landed and questioned the GI in the cockpit. The GI said that his platoon sergeant had told him to ride inside the "Huey" and hold the collective down during the sling load flight.

Adapted from Headquarters U.S. Army Vietnam Aviation Pamphlet July 1969

Miniature Survival Kit

THERE is a proposal being circulated for a new, compact survival kit to be used by A-4 drivers. The lack of space in *Skyhawk* cockpits has made this piece of gear appear attractive. The kit is composed of a one-by-two inch packet in which will be placed a very small bottle of gin, an even smaller bottle of dry vermouth and a tiny martini glass. The theory behind its use is that should a pilot be forced to eject and finds himself in an isolated area, he is to open his packet and commence making himself a martini, at which time someone will invariably show up on the scene and say, "Here, let me show you how to do that right." Further assistance may then be requested by the downed airman.

Cold Starting Tips For Recips

Less throttle
More prime
She'll start
First time.

High Key

ONE night enroute from NAS Pensacola to NAS New Orleans in a trusty UH-34, the pilot experienced difficulty with uncontrolled, increasing throttle setting. Power gradually increased to 41 inches manifold pressure and 2600 turns. In order to keep his airspeed/RPM/MAP within limits a slow, steady climb was necessary. When he arrived at his destination he had finally eased up to 8500 feet. The weather was VFR all the way so it presented no problem. When he got to NAS New Orleans he secured the engine and autorotated to the deck. Postflight inspection revealed the throttle box bolt was missing. – *Tsk! Tsk! Nuf said.*

Flying Workstand

WORKSTANDS and boarding ladders don't fly, but they will sail in a good wind, prop wash or jet blast. Damage isn't usually great when one sails into a parked aircraft but the reporting paperwork is a pain. Lock brakes or tie these pieces of equipment down when they're not in use. ◄

TOP GUN

The Mk-4 Gun Pod

FOR those of you who have been curious about what goes on inside the Mk-4 gun pod, but who haven't gotten around to studying the Tech Manual, the following short summary should be of interest. To those interested in automatic weapons, the unique features of this gun will be apparent at once i.e.: the momentum balance system of operation and the twin smooth bore barrels.

First the vital statistics:

Rate of Fire	4000 or 700 rounds per minute (selected prior to launch – not selectable in flight)
Weight fully loaded	1390 lbs.
Ammunition-full load	750 rounds (594 lbs)
Length	191.35 inches
Diameter	22.5 inches
Gun	Mk-11 Mod 5 (Twin barrel, revolver, electric firing)

Next, some rather interesting facts about the gun itself. As noted above, it is a two barrel revolver. The barrels are installed in the breech assembly in an over and under arrangement. The revolver cylinder looks like a very oversized revolver cylinder from an eight chambered hand gun. Here the similarity stops. Within the front end of each chamber is a rifled insert and a movable sealing ring. The replaceable rifled insert spins the projectile to 130,000 rpm in its first two inches of travel. As the projectile enters the barrel it is traveling about 900 fps and accelerates to 3300 fps by the time it leaves the muzzle. Since the barrel has a smooth bore, no further spin is imparted. In fact, spin decreases as a result of bore friction to 115,000 rpm by the time the projectile leaves the muzzle.

While firing, the entire gun mechanism, including the barrels, breech assembly and revolver cylinder, recoils and counter-recoils within the receiver. During this back and forth motion the revolver cylinder is indexed 45 degrees per cycle bringing two chambers in line with the barrels at the end of the counter-recoil stroke. During a normal burst the two live rounds aligned with the barrels are fired just before the gun reaches the end of the counter-recoil stroke. One round absorbs the counter-recoil momentum while the other round causes the gun mechanism to start another recoil stroke. If the

A "six gun" A-4C. Three Mk-4 gun pods and part of their full load.

trigger is released, however, only one of the two rounds is fired. Since one round absorbs the counter-recoil momentum there is no surplus momentum to start the recoil cycle. The gun thus stops firing with one live round at the first-round barrel position and one expended round at the last-round barrel position. When the trigger is next depressed the first-round barrel fires, starting the recoil motion for an entire firing cycle.

The first-round barrel is ported about 10 inches ahead of the breech face to tap propellant gases which play a vital part in the automatic operation of the gun. Some of the gas is used to charge the two rammers which strip the rounds from the links and charge them into the revolver. Some of the gas is routed down tubes and is used to blast the empty cases from the eject stations in the revolver. The empty cases are blown rearward hard enough to seat in empty links and strip them from the belt. The links and cases then exit the gun pod via the empty case tubes. The remainder of the gas ported from the first-fire barrel is used to boost the recoil stroke, providing the energy necessary to overcome friction and to increase the rate of fire. As you can see, all gun power, with the exception of the firing circuit and electrical control system requirements, is furnished from the energy of the propellant gases or from the pod pneumatic system when clearing or charging. The pneumatic system also supplies the power to drive ammunition from the magazine to the loader. This use of propellant gas energy is typical of an automatic weapon as contrasted to a power driven weapon such as the Vulcan 20mm cannon (M61A1) now in use in the A-7E aircraft.

With all of these details behind us, let's see what happens if a dud round appears during a burst. As you recall, the gun fires two rounds at the end of the counter-recoil stroke, one stopping the gun and the other causing the gun to recoil. If a dud arrives at one of the two firing stations, only one round fires and the gun stops. An electrical sensing circuit, which is always energized when the trigger is depressed, recognizes the stoppage. It initiates a charging cycle using 1500 psi air or nitrogen from the pod pneumatic system 0.08 sec after the failure to fire both rounds. This high pressure gas is fed along basically the same paths as the propellant gases used during automatic operation. It ejects the spent cases, charges the rammers, drives the gun into a

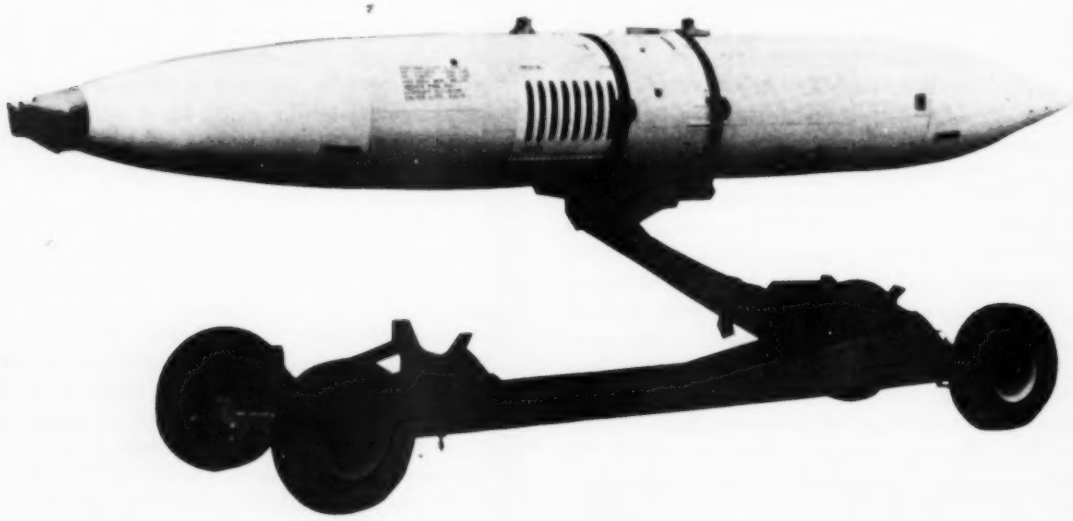
full recoil and counter-recoil stroke causing fresh rounds to be brought to the firing station and when these fire, the gun resumes its fully automatic operation. You will know that this has happened only by a momentary hesitation of the gun during a burst. Note that the dud round, complete with projectile, will be ejected with its link.

Upon completion of a mission and prior to return to base, the pilot should clear the gun mechanism by activating his "clear" switch. When this is done, the loader is declutched and the charging cycle described above is initiated. The gun cycles without firing until all empty and live rounds are ejected from the revolver. About one-half second is required to allow the gun to cycle three times clearing all rounds. It is important to note that live rounds (up to four, but usually three) will be ejected during the clearing cycle but no links will be ejected. If an attempt is made to fire the gun again after clearing, the empty links will jam the mechanism, the gun will not fire and your ordnanceman will not be overjoyed. Don't clear the weapon if there is any possibility you will need the gun again before you end the mission. Don't clear it over populated areas because you are ejecting live rounds. Some other thoughts for pilots using the pod and aimed at keeping both the pilot and the gun in good health are discussed below.

A short calculation will reveal that at 4000 rounds/min, only 11.25 seconds of firing is required to empty the entire full load of ammunition. The gun, however, simply will not take punishment like that. The barrels will probably end up looking like wet noodles on a damp day if you should attempt a complete fire out. Normally firing should be restricted to one and one-half to three second bursts with a three minute cooling period between bursts. A five to six second burst can be fired if essential to the mission. After such a long burst a six minute cooling period should be observed before attempting to fire the gun again. The latest information direct from NavAirSysCom indicates that the danger of cook-off is present only after firing a continuous burst of 500 rounds or more. This is equivalent to a 7.5 second burst at 4000 rounds/min. A series of short bursts with only a second or two pause between bursts heats the gun as much as firing the same number of rounds in a single burst. Thus this method of firing does nothing to increase gun life or reduce malfunctions. *(The information in the preceding paragraph is forthcoming in the form of a change to the operating limits of the Mk-4, to be promulgated by NavAirSysCom – Ed.)*

A final thought for your safety – don't fly behind and below another aircraft which is firing, charging or clearing a Mk-4 pod. The empties, live rounds and links are ejected downward and to the rear in any of these operations. With a proper dose of TLC (tender loving care) from the ordnance crew and a little dose of the same plus understanding from the pilots, the Mk-4 gun pod can truly be "Top Gun."

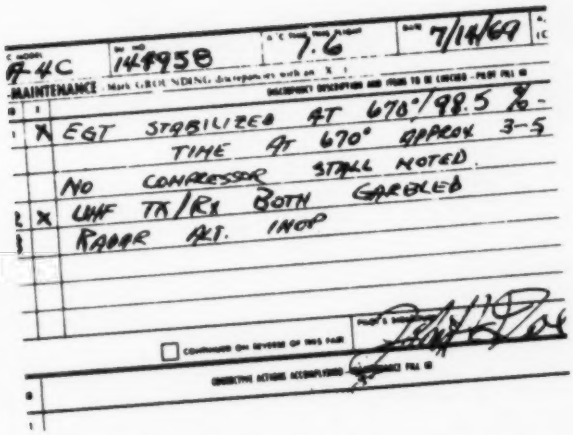
Further details on this gun's operation, including the magazine, feed system and the loader mechanism, can be found in chapters one and two of NAVAIR 11-95-8. ◄



A Mk-4 gun pod on a Mk-7 trailer.

Engine life is directly related to its operating temperature.

Observe the limits of RPM and EGT when operating at higher thrust settings and/or on the emergency fuel system. *Do not exceed the limits prescribed in the flight manual.*



Whenever the allowable limits are exceeded, report it as a discrepancy on the yellow sheet. The max temperature reached and the amount of time the temperature was above the limit are of critical importance.

When the mission requires, use all the thrust that is necessary, up to the prescribed maximum. If there is no rush, operate the engine conservatively to increase engine life.

Whenever high EGT cannot be controlled or limits have been exceeded, land as soon as possible using the minimum thrust required to sustain flight.

Many naval aviators utilize Air Force facilities from time to time and the following article contains information that could prove to be most important in the near future.

You're sitting pretty on GCA final . . . but could *you* do as well with ILS — if need be?

GCA and YOU

By Lt. Col. F. G. Schellenberger
Hq ADC (ADOOPSC)

Courtesy USAF "Interceptor"

IN AUGUST 1968, AFCS (Air Force Communications Service) requested that all commands analyze their requirements to identify possible operational areas in USAF operated towers, RApCon (Radar Approach Control) and GCA units which might be curtailed to alleviate AFCS manning problems. The ADC (Aerospace Defense Command) reply indicated this command could accept a reduction in the hours of GCA operations at certain dispersal bases. It was also indicated that, if required, we could abandon our requirement for a multiple approach capability at main operating bases during the hours of darkness, providing a single approach capability would be maintained. (Note: A word of explanation is in order here. AFM 60-5 defines a multiple approach as follows: "Radar approaches that involve the control of more than one aircraft on final approach at the same time." Conversely, a single approach capability provides for the control of not more than one aircraft at a time on the final approach.) It naturally follows that fewer GCA controllers are required to provide a single approach capability. For the studious reader, we hasten to point out that ADC also indicated a requirement for a recall capability to handle emergency situations and to provide normal services for our routine exercises during the "dogwatch hours."

By April 1969 the situation had come to a head. All commands were notified that AFCS had reached an untenable situation and that corrective action was being taken; however, due to the long lead time involved in training additional personnel, it will take two years to reach a get well date. A quote from the USAF message is enlightening. "Eleven air traffic control facilities have already curtailed services with 40 others operating at emergency manning levels. They (AFCS) forecast that during the next 12 months approximately 50 air traffic control facilities will be forced to curtail services and 40 will be operating with only one skilled controller above a curtailment situation . . . a preliminary listing indicates that air traffic control services, primarily radar, may be curtailed at as many as 52 ConUS bases." To the really eager among you, this may represent a challenge – we call it a first class problem.

In recognition of the criticality of the problem the Air Staff formed a study group. This group put their heads together and came up with a proposed solution. Extracts from the follow-on staff action indicate the "mid shift (normally 0000 to 0800 LOCAL) GCA operations may be reduced to an ILS vectoring service and/or ASR/PAR single approach capability . . . where a PAR final approach is required, ILS vectoring service or control of other aircraft must be discontinued during the PAR phase . . . this can be performed by one skilled controller." Further, it was noted that at USAF RApCons, reduction of personnel on the mid shift, where ADC has an alert commitment, will be limited to a minimum of two skilled personnel to provide approach control service and ILS vectoring service and/or single approach ASR/PAR service. USAF PAR service at joint RApCons supporting ADC alert commitments can be deleted during mid shifts at locations where FAA has the capability and will agree to provide PAR service, if requested, during marginal weather and aircraft emergency conditions.

The situation then remained dormant for about as long as it takes to read back an abbreviated flight plan. AFCS followed with a message to all their unit commanders directing them to coordinate with their host commanders to inform them of forthcoming curtailments in GCA operations. Curtailments are to go into effect as controller personnel are lost due to normal attrition. In addition, AFCS wisely pointed out the need for supporting notam action. "For ADC bases, notam information should include that, except for emergencies, pilots should expect at least a 30 minute delay for radar approach service during the appropriate time periods and that the facility will be limited to a single aircraft approach capability during that time frame. At joint FAA/AFCS RApCons the notam will indicate that PAR service will not be available during the mid shift." AFCS has also indicated that GCA minimum manning will be reduced to that authorized in paragraph 222 of AFM 60-5. GCA units will be reduced to one senior controller and one nonrated controller qualified to perform assistant controller duties. It should be clearly understood that USAF radar facilities will be limited to single aircraft approach capability when PAR approaches are required. A check of paragraph 222.2 of AFM 60-5 indicates that "facilities operating under . . . the manning described above . . . will limit traffic handling to one aircraft at a time under radar control."

It occurs to us that reasonable prudence dictates that both aircrew and supervisory personnel should take a long hard look at the ramifications involved in this situation. We anticipate that the average aviator will be thoroughly brainwashed with the situation as it exists at homeplate. However, we ask you to consider, for a minute, the situation where you have been nominated to take part in an exercise or an active air defense mission and homeplate goes WOXOF. How about a suitable alternate . . . what is the recovery capability at your alternate base? Do you have sufficient fuel to hold a possible 30 minutes while other aircraft are being recovered? Does the intended or alternate base have an ILS runway which is suitable? Do you have ILS capability? How proficient are you on ILS? In other words, it is incumbent upon the pilot, the supervisor and the mission planner to be totally aware of the recovery capability existing where a single or mass recovery is intended. ◄

Check notams for destination *and* alternate.

Stoofmare

THE aircraft assigned to me for a day launch had been written up the night before with a few discrepancies. The starboard engine had been running rough and cutting out. A maintenance inspection and turnup had failed to disclose any malfunction so the aircraft had been put up for flight.

I was aware of the previous malfunction and had mentally prepared myself for any engine difficulties which might arise during the hop. After full power had been obtained on the catapult, the starboard engine RPM fluctuated momentarily. Things settled down to normal, however, so a smart salute was rendered. As the catapult officer reached the fire position the engine began to lose RPM again. Off we went . . . and then the fun began. I am a tall man and sit rather high in the cockpit and as we were being shot down the H-8 catapult my head naturally was rammed back against the head rest. The visor shield of my hardhat wedged behind the T-handle of the overhead hatch. My chin strap was tight and I was lodged there with my head looking up and unable to see well enough to provide any forward yoke control. We must have looked like a launch at Cape Kennedy.

I hit my copilot with my free hand and he took control and recovered the aircraft from its moonshot attitude. The engine continued to run rough and once I had disengaged myself from the overhead hatch, we recovered on board.

After we returned to the ship the safety officer and I tried to reconstruct what happened. We discovered two things. First, the head rest was not all the way up on the seat; if it had been, I could not have lodged myself in that embarrassing position. Secondly, I didn't have my visor down because the weather was a solid overcast and very grey. The use of a clear visor would have kept the T-handle from wedging my hardhat.

Head-up-and-Locked Mouse

The purpose of Anymouse (anonymous) Reports is to help prevent or overcome dangerous situations. They are submitted by Naval and Marine Corps aviation personnel who have had hazardous or unsafe aviation experiences. As the name indicates these reports need not be signed. Self-mailing forms for writing Anymouse Reports are available in readyrooms and line shacks. All reports are considered for appropriate action.

— REPORT AN INCIDENT, PREVENT AN ACCIDENT —

Thanks for passing on this interesting experience. It may prevent some other Stoof or C-1 pilot from encountering similar trouble in the future. But aside from that, it also should be pointed out that accepting an aircraft with a known but uncorrected engine discrepancy is not conducive to a long or healthy life.

Excellent Recommendation

DURING the fueling of a drop tank with a gravity fueling nozzle, a Lazy Mouse inserted a screwdriver into the handle so that he would not have to keep constant pressure on it. One of his friends, noting that the hose was in an awkward position, decided to move it. As a result the fuel nozzle flipped out of control spraying the Lazy Mouse and the surrounding area with JP-5 until the screwdriver was removed and the "dead man" handle was allowed to function in its normal manner.

Recommendation: That all fueling personnel be cautioned again that inserting anything into a fueling hose nozzle mechanism is unauthorized and could lead to an unscheduled shower of JP-5.

Wiser Mouse

An excellent recommendation as your experience has amply demonstrated.

Confession

WHILE flying at low level, high speed (1000 feet and 400 knots) I pulled the nose of my TF-9J up to 30 degrees and relaxed the G to begin a series of flaperon rolls. With the stick fully deflected to the left, I decided to experiment with a little forward stick at the beginning of the second roll. The rate of roll was noticeably faster and smoother with application of slight forward stick pressure, so I thought I'd add a little more. Upon increased application of forward stick on the fourth roll, I experienced sudden negative G throwing me up against the canopy. Hanging in the straps and unable to reach the stick and rudders, I was helpless to control the plane as its nose fell toward the ground in the inverted position. (When I lost control, the plane stopped rolling and stabilized in the inverted position.) My first impulse was to cover my head and duck, but somehow I righted the airplane (I don't recall doing it), arrested my descent somewhere between 500 feet and the deck and then concentrated on slowing my heartbeat . . .

Anymouse

This anymouse report ended, apparently, in mid-sentence . . . but it's just as well. We got the point. We hope that our readers (and particularly, Anymouse) get the point, also – performing unauthorized maneuvers at low altitude is frequently a shortcut to eternity, and most particularly, forward stick and loose restraining gear can leave you jammed into the top of your canopy. Strict compliance with approved procedures is the only approach to professional airmanship.

Tower/GCA Coordination

MY SECTION of TA-4Fs was cleared by the tower to contact GCA for a PAR low approach. We were on the glide slope about three and one-half miles from the end of the runway when we were overtaken by an A-7. The A-7 was about 200 yards past the lead TA-4F when he descended in front of us. When the A-7 passed the 12 o'clock level position, with about 300 yards separation, his jetwash rocked the No. 2 TA-4F. It's my guess that the A-7 pilot never saw us.

I recommend that tower controllers better coordinate clearance for GCAs, straight-in approaches and the field pattern. There is no excuse for more than one section or aircraft being cleared to land/make a low approach at the same time, particularly during periods of low visibility or at night. This also emphasizes the need for heads-up work by both pilots and controllers.

GCA Mouse

Heads-up work by both pilots and tower controllers is the answer to problems such as this. This implies that the tower will maintain effective coordination of all traffic in the field and GCA patterns, establishing approach and/or landing priorities early enough to avoid traffic conflicts. We hesitate to say that intensive operations should not be conducted at night or during periods of low visibility since much valuable training is done during these periods, but we do not hesitate to say that all field/approach traffic must be positively coordinated – particularly at night or during low visibility conditions.

Our air traffic controllers handle literally millions of such operations annually but neither pilots nor controllers can relax their guard. Uncoordinated approaches and naval aviation safety do not mix.

GAMES PI

"I Can Lose It Before My Next Physical"
Also known in some circles as "Glutton, Glutton, Who's a Glutton?"

"I Ca
Th as it
as Fudgi
Nowere."

"Just A Little Cold" or "Blockhead"

"I Can Hold My Likker"
Variations of this game are "Sphin the Bottle" and "Under the Table."

Whe
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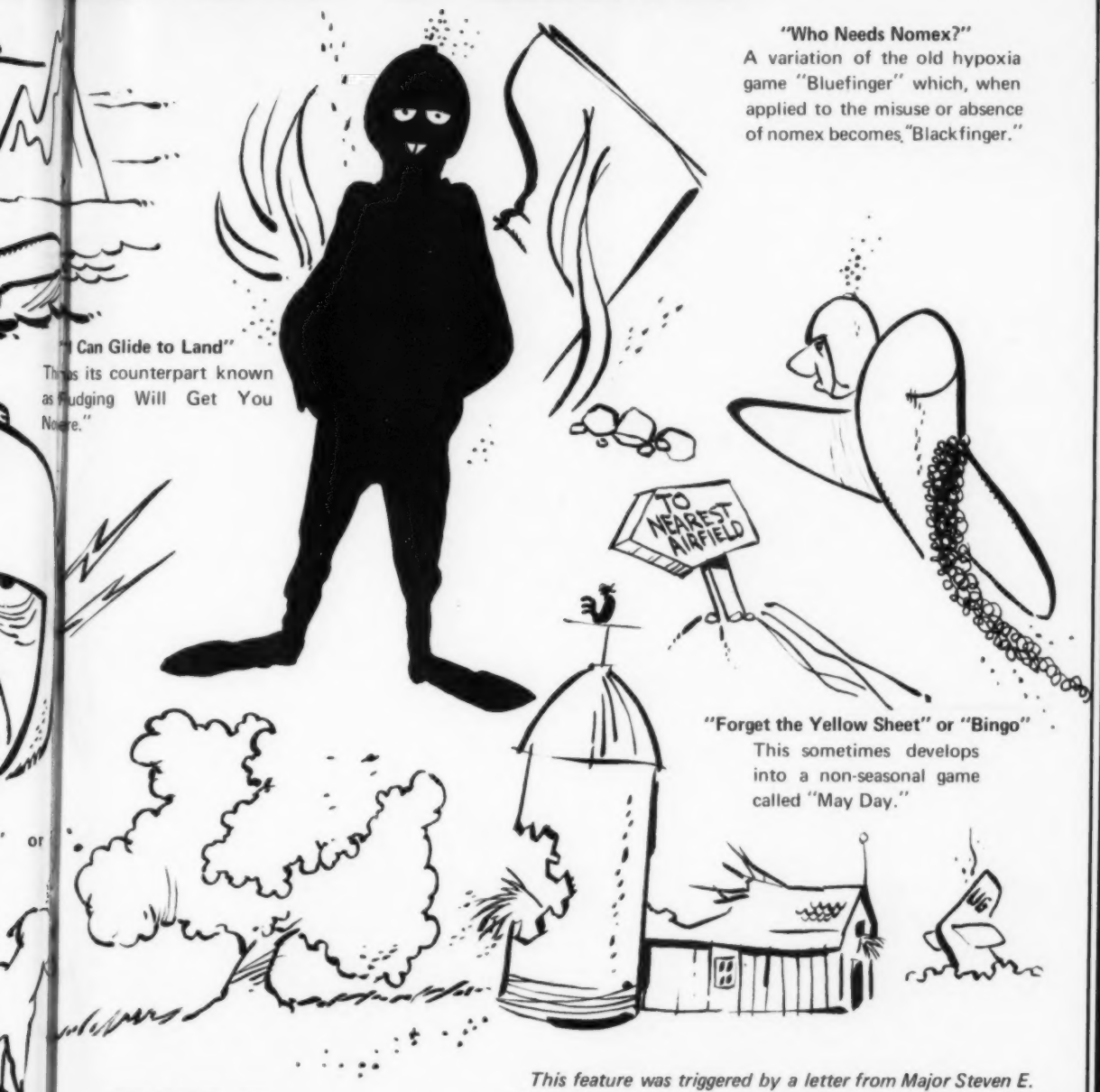
ILOTS PLAY



"Who Needs Nomex?"
A variation of the old hypoxia game "Bluefinger" which, when applied to the misuse or absence of nomex becomes "Blackfinger."

"I Can Glide to Land"
This its counterpart known as Pudging Will Get You Nowere."

"Forget the Yellow Sheet" or "Bingo"
This sometimes develops into a non-seasonal game called "May Day."

"Who ME Tired?"
When carried to extremes may also be known as "Buy the Farm."

This feature was triggered by a letter from Major Steven E. Field, USMC, ASO, HMH-461, MAG-26. Any of the rest of you out there have any games to share with our other readers? – Ed.

ALCOHOL

NOW that the Christmas and New Year's holidays are past, how do you feel? Chances are you made merry at some time during the holiday period. For the sake of your honorable headbone, in consideration of the folks who had to endure your company postparty *and* in the interests of aviation safety, we hope you celebrated with some moderation.

Without alcohol there would be no such thing as the cocktail party. Wine with meals is a civilized pleasure and a beer or two with the gang or in front of the TV set is a great way to unwind at the end of the day. But heed ye these words of wisdom: drink in moderation and *never* if you're going flying in the next 12 hours.

The "Life of the Party" probably is under the impression that drinking is stimulating. He couldn't be more wrong. Alcohol is a depressant. What makes the "Life" think otherwise is that the first effect of alcohol on the brain is to slow down the area which controls judgment and thought. Alcohol relieves you of the inhibitions which usually ride herd on your behavior. Since the "Life" is less inhibited and more relaxed than usual, he may feel free-and-easy at first and before you know it, he's said Something Awful to Someone-Very-Important. The more he drinks, the more the depressant action of the alcohol increases. Pretty soon his friends don't have to worry any more about what he's going to say or do next – he's passed out cold.

What about the next morning?

No matter what semi-secret sobering formula that generous bartender in Naples, Hong Kong or San Francisco has let you in on, it takes approximately one hour for a man of average weight (about 160 pounds) to clear 1/3 of an ounce of alcohol from his system.[1] (The accompanying chart gives you the benefit of a slightly faster rate of elimination.) Coffee can help keep you awake and counteract the depressant effects of the booze and tomato juice concoctions give your stomach something to do beside growl, but none of this will hasten the elimination of the alcohol you've taken on. The only thing you can do is wait for your body to burn it up. Think about how many drinks your imbibing buddy put away last night, look at your watch and calculate a bit to see if you'd like to fly with him today. If he has as much as one ounce of alcohol still in his bloodstream (and his brain!) it's as if he had taken two stiff shots of 100 proof whiskey on an empty stomach just before takeoff. (Mull that one over!)

Hangover Hazard

A hung-over pilot is an unsafe pilot.

Although a person who has been drinking may not show any signs of intoxication, he can most definitely still be Under-the-Influence. He doesn't have to stagger and lurch to the aircraft to make a fatal slip in judgment or coordination in flight. Some experts now think that even after all traces of alcohol are gone from the drinker's blood, it's still on his mind – there's some kind of residual chemical effect at work in his brain.

Alcohol also affects your vision. It constricts your visual field and it reduces your ability to see in dim light or at night. Two cocktails, or about 0.04 percent alcohol in the blood, can reduce your visual acuity as much as wearing dark glasses at night.

Effects of Alcohol

Alcohol also has a pronounced effect on your memory, your judgment and your reasoning. For example, scientific experiments have shown that alcohol reduces one's ability to memorize poetry and interpret codes. Obviously you won't be learning "The Face on the Barroom Floor" in the cockpit but you can see a parallel to the business of carrying out your aviation chores.

A pilot or crewman with alcohol in his blood is especially vulnerable to hypoxia, even at moderately low altitudes. This is because alcohol exercises its primary physiological action by depressing oxidation in the cells. At 10,000 feet, the alcohol in two or three cocktails has the physiological action of four or five drinks at sea level. The pilot or crewman who drinks before flying in effect "lowers his ceiling" considerably.

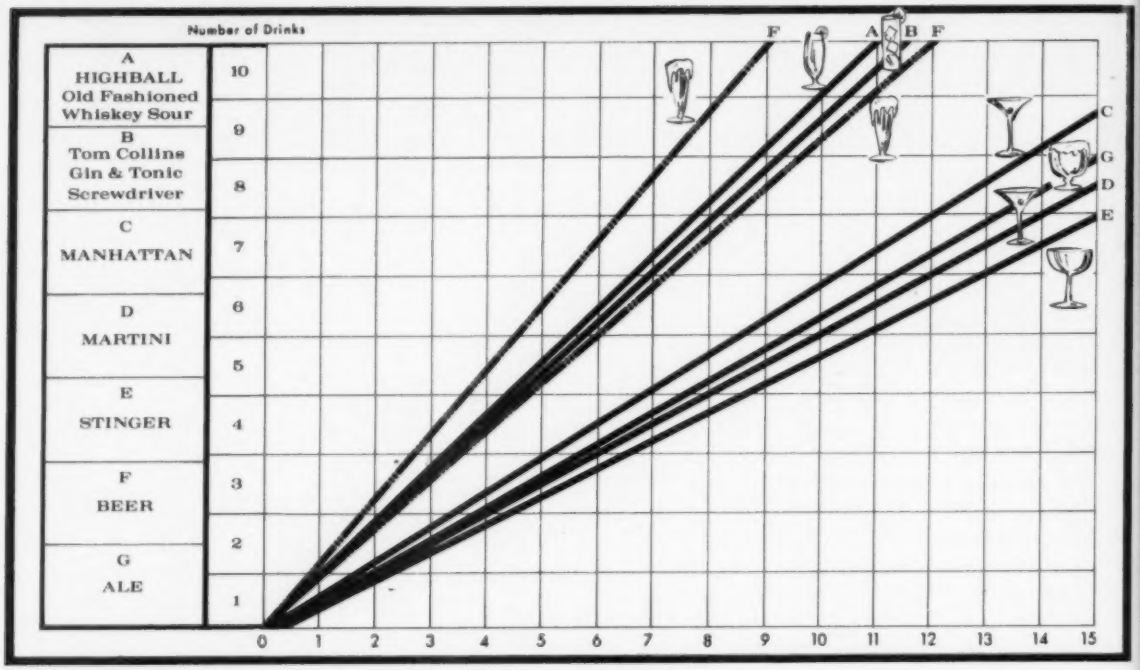
So What?

"So what else is new? Everybody knows all this."

Not so, apparently, or if everybody knows, somebody's not paying any attention.

During the two-year period ending last July, there were 11 accidents and flight incidents recorded in which

[1] *Navy Flight Surgeon's Manual*, p. 662.



Elimination is based on an average rate of .4 oz ethyl alcohol per hour.

A (Highball, etc.) is a drink of 1 oz 87 proof whiskey or rum = .44 oz ethyl alcohol

B (Collins, etc.) is a drink of 1 oz 90 proof gin = .45 oz ethyl alcohol

C (Manhattan) is 1.3 oz 87 proof whiskey, .6 oz 36 proof vermouth = .71 oz ethyl alcohol

D (Martini) is 1.5 oz 90 proof gin, .5 oz 37 proof vermouth = .77 oz ethyl alcohol

E (Stinger) is 1.3 oz 90 proof brandy, .6 oz 60 proof creme de menthe = .80 oz ethyl alcohol

F (Beer) 3.2% to 5.0% beer, and it varies even more = .38 oz to .48 oz ethyl alcohol

G (Ale) approximately 6% = .72 oz ethyl alcohol

Example for above chart: 3 Stingers (the most potent cocktail) consumed in a half hour, and for the next 6-1/2 hours your body will be busy eliminating the 2.4 oz of ethyl alcohol you've tossed "down the hatch."

pilot drinking turned up in the investigation. Besides this, common sense tells you that for every known instance there must have been others in which pilots and aircrew lucked out and managed to salvage a bad situation, ergo, no official report.

A quick review of some of these alcohol cases will give you a feel for the problem.

Let's start with the only incident in the group. Although the aircraft was finally landed safely, three persons bailed out during the flight and one of them was lost.

Good to the Last Drop

The pilot had been drinking prior to flight and had been drinking heavily during recent weeks. (This had caused an argument between him and one of the officers in his crew and there was open hostility about the subject.) Shortly after takeoff the pilot removed his oxygen mask, as was his custom, accepted a cup of coffee and lit a cigarette. As he placed the coffee cup on the console, he made a remark about being able to do such and such a maneuver without spilling a drop. The first time he got away with it (the maneuver was described by some as a steep turn and by others as a roll) but the second time coffee spilled all over the place.

There is some confusion about exactly what happened next. The pilot states that he reached for his oxygen mask and lost control of the aircraft at 19,000 feet but that he was conscious the whole time. He successfully recovered and returned to straight and level flight at 6000 feet. However, an officer in the crew states that while the aircraft was pointed down, still with climb power on, he had time to hit the pilot's leg several times, call for speed brakes, blow the escape hatch and commence egress – all before the pilot reduced power and dropped the speed brakes.

The investigating flight surgeon mentions disorientation, hypoxia, smoking and lack of food and sleep as well as alcohol intake. (The pilot had not gotten sufficient sleep and had eaten no food for nine hours prior to this flight, his second of the day.) Our interest

C
G
D
E

BLOOD-ALCOHOL CHART

SHOWING ESTIMATED PERCENT OF ALCOHOL IN THE BLOOD BY NUMBER OF DRINKS IN RELATION TO BODY WEIGHT

BODY WEIGHT	DRINKS 1	2	3	4	5	6	7	8	9	10	11	12
100 lb.	.038	.075	.113	.150	.188	.225	.263	.300	.338	.375	.413	.450
120 lb.	.031	.063	.094	.125	.156	.188	.219	.250	.281	.313	.344	.375
140 lb.	.027	.054	.080	.107	.134	.161	.188	.214	.241	.268	.295	.321
160 lb.	.023	.047	.070	.094	.117	.141	.164	.188	.211	.234	.258	.281
180 lb.	.021	.042	.063	.083	.104	.125	.146	.167	.188	.208	.229	.250
200 lb.	.019	.038	.056	.075	.094	.113	.131	.150	.169	.188	.206	.225
220 lb.	.017	.034	.051	.068	.085	.102	.119	.136	.153	.170	.188	.205
240 lb.	.016	.031	.047	.063	.078	.094	.109	.125	.141	.156	.172	.188

SEE INSTRUCTIONS ON REVERSE SIDE

Hrs. since 1st drink . . .	1	2	3	4	5	6
SUBTRACT	.015%	.030%	.045%	.060%	.075%	.090%

THE REMAINDER IS AN ESTIMATE OF THE PERCENT OF ALCOHOL IN YOUR BLOOD.

Example – 160 lb. man, 8 drinks in 6 hours
.188% minus .090% = .098%

INTERPRETATION OF RESULTS

Percent of Blood-Alcohol	Intoxicated?	If You Are a Pilot
.001 to .050	You Are Not	Don't Fly
.050 to .100	You May Be	Don't Fly
.100 to .150	You Probably Are	Don't Fly
.150 and Above	YOU ARE	Don't Fly

COURTESY – ILLINOIS DEPARTMENT OF AERONAUTICS

Blood-Alcohol Chart Wallet Card

This wallet card, courtesy of the Illinois Department of Aeronautics, was passed to us by Dr. Stanley R. Mohler of the FAA. It is an excellent guide for determination of time required for oxidation of ingested alcohol. However, as we all know too well, this isn't the whole story. *Don't forget the hangover.*

here is principally with the alcohol. Within 12 hours of takeoff the pilot had consumed at least five cans of beer and six ounces of scotch. Two of the beers and all of the scotch went down within eight hours of the flight. Also of significance was the fact that the pilot was in the habit of smoking two or more packs of cigarettes a day. Because hemoglobin has a greater affinity for carbon monoxide than it does for oxygen, a smoker such as this pilot has less space in his blood for oxygen, so to speak. On top of this, alcohol, as we said earlier, depresses oxidation in the cells. Minimal hypoxia, the investigating flight surgeon states, tends to accentuate the effects of even a small amount of alcohol which may remain in the bloodstream. At a cabin pressure altitude of 8000 feet the increased effect of even a small amount of alcohol can be detrimental to pilot performance. The pilot's heavy smoking plus his boozing effectively lowered his physiological altitude considerably.

Cockpit Confusion

Cockpit confusion aptly describes the next mishap. The UH-34D pilot had completed putting away 10 gin and tonics and a beer eight hours before the flight. At the end of the flight the copilot's landing approach was fast. The pilot tried to take control but failed to make a complete correction and the aircraft overshot the landing zone. Engine RPM fell off and the pilot dropped the collective. The aircraft struck the ground and began to vibrate. The pilot tried to secure the engine and took his hand off the collective. Thinking the aircraft was going into ground resonance, the copilot pulled sharply up on the collective to get airborne and the aircraft began to rotate. The pilot got control and put the helo back on deck where it rolled over on its side.

The time lapse between the pilot's final drink and takeoff was insufficient for him to completely metabolize the amount of alcohol consumed, analysts state. (Remember the rate – 1/3 of an ounce of alcohol per hour.) Although the mishap occurred some 2 1/2 hours after takeoff, investigators felt that at the very least the effects of the pilot's hangover would have derogated his decision-making ability.

Gin and Tonics

Gin and tonics – about 15 of them the afternoon and night before – figured in another helicopter accident which occurred during this two-year period. This one resulted in strike damage but no injury to the pilot and only minor injury to the crew chief.

The helo pilot had just made two early morning trips to deliver VIPs. To pass the time before going back to pick them up, he proceeded to an unauthorized landing area, a sandbar two miles north of the VIP landing zone, to practice landings. He allowed the crew chief to fly the helo from the left seat on five landings and takeoffs while he monitored the controls and then he executed two slide-on landings. The accident occurred during the third takeoff. Halfway through the takeoff turn the helo accelerated to the right. Full left rudder could not stop the rotation and the helo struck the sandbar. The accident occurred at 0930.

"The activities of the pilot the evening prior to this accident, in that he consumed an inordinate amount of alcoholic beverage, are considered to have a possible direct bearing on this accident," the fifth endorser to the accident report wrote.

Comes to Light

Sometimes alcohol doesn't cause an accident or even contribute to it but because of other factors, it comes to light. Such was the case of a material-failure-caused gear up landing accident in an F-8. The squadron C.O. termed the pilot's diet "bizarre," and well he might.

The Sunday morning before the Tuesday on which the accident occurred, the pilot drank a beer when he got up. At 1600 he ate two hamburgers, two hot dogs, a dill pickle and consumed five beers – his only meal for the day. That evening he had seven scotch and sodas in the BOQ bar with friends and was off to bed at 0200. Monday he got up at noon. His breakfast consisted of two minute steaks, potatoes, milk and two cups of coffee. That afternoon he had six rum drinks, two meatballs and two bags of nuts. Somewhat later he drank two beers and ate a pizza and, still later, drank five scotch and sodas, ate two brownies and a sandwich and at 0100 went to bed. The day of the accident he got up at 0800 and breakfasted on four cups of coffee (with sugar).

An endorser noted that the locale in which the accident occurred was an area "where cheap liquor provides for *heavy* two-ounce drinks."

"The pilot was obviously underfed and it is highly probable," the endorser wrote, "that his body had not fully assimilated the alcohol he had consumed."

By now, the point should be made. It's not to say that moderate consumption of alcohol will wreck your system and make you altogether forget everything you ever knew about flying; but *if you are going to fly tomorrow, don't booze it up tonight.* And a breakfast of good old bacon and eggs (not the hair of the dog that bit you, or four cups of coffee) is a step in the right direction. RONs are not for drinking like it's going out of style and squadrons shouldn't celebrate their departure from an area with a Big Party the night before they leave.

Wouldn't it be outstanding if instead of the saying "sober as a judge" it could be said "sober as a Navy pilot about to fly?" ◄

LPA-1 Life Preserver

A VA-72 pilot executes a crawl stroke with ease while wearing a fully inflated LPA-1.

ALTHOUGH the timetable is not yet firm, the LPA-1 life preserver assembly will eventually replace the Mk-2 life vest, the Mk-3C and LPU life preservers presently authorized for pilots and aircrewmen. (The only exception is that helicopter combatant aircrewmen will continue to wear the LPP-1 with T-65 body armor.)

The LPA-1 life preserver is a big improvement over existing personal flotation gear:

- *Across-the-board compatibility:* The new life preserver goes with all kinds of equipment configurations. It does not interfere with removal of the standard parachute harness and it can be inflated during parachute descent when worn with either the integrated or the standard parachute harness.
- *Improved flotation:* The LPA-1 offers a minimum of 65 pounds of buoyancy which is greater than any other unit of personal flotation gear presently used in Navy aircraft. It automatically rotates a face-down survivor and supports him in a 45 degree face-up position in the water.
- *Comfort:* By eliminating bulk in the back area, the LPA-1 makes the "Mk-3C callus" a thing of the past for wearers of the torso harness. The LPA-1 is not as bulky as the Mk-2 when worn beneath the standard parachute harness.

Show and Tell

The very best way to familiarize yourself with the LPA-1 is to get your squadron survival equipment officer or one of your riggers to take one of the new life preservers in hand and "show and tell." For those of you who do not have access to this new piece of equipment, here is a verbal description.

The LPA-1 weighs four pounds and, as we said earlier, provides a minimum of 65 pounds of buoyancy. It has a two-compartment flotation assembly, a casing assembly and two detachable optional survival equipment pouches marked for signal flares and dye markers.

When you put the LPA-1 on, you weave the belt on your SV-2A survival vest or your MA-2 torso harness

Wearing an inflated LPA-1 a VA-72 pilot swims with the breast stroke. Pilots in these water photos are wearing flight deck protective helmets vice APH helmets.

A "survivor" treads water. Note how the collar lobe of his inflated LPA-1 encircles and supports his head.

Extending his arms almost completely out of the water, this VA-72 "survivor" had been in this position some 10 seconds when this picture was taken.

The "survivor's" shoulders are well out of the water as he floats comfortably and uses both hands to operate signaling equipment.

through the three belt keepers on each side of the preserver. Each belt keeper has a D-ring on it. The optional survival pouches snap on the two back D-rings on each side of the wearer.

Inflation

To inflate the LPA-1 you pull the two inflation toggles down and forward simultaneously. If for some reason you can't pull the toggles at the same time, pull the *right* toggle first. Pulling the toggles releases the casing envelopes for the waist lobe flotation cells and punctures the CO_2 cylinder seals. The right toggle inflates part of the right waist lobe and also the collar lobe which is connected to it by tubing. The left toggle inflates the rest of the right waist lobe and all of the left waist lobe. Inflated, the waist lobes will be in the area of your lower ribs. The inflated collar circles your neck and rests on your shoulders. If your preserver should leak or the inflator assemblies fail to work properly, use the two oral inflation valves to top off inflation.

Minor deficiencies in design have been brought to the attention of NavAirSysCom (Naval Air Systems Command). Squadrons experiencing difficulties or desiring to make recommendations should, as with all personal survival equipment, make use of the Flight Safety UR (Unsatisfactory Report) System.

What do aviators and aircrewmen who have the new life preserver think of it?

On the basis of evaluations by HC-4 Detachment NorVa, VA-152, CVW-13, HC-2, and tests conducted by NARF (Naval Aerospace Recovery Facility) El Centro and the Naval Missile Center, the preserver was procured in quantity for issue to the fleet.

Enthusiastic reports of operational use have been received from VA-86, the squadron doing the initial operational evaluation and more recently from VA-72.

VA-86's pilots were unanimous in their approval of the LPA-1, both for comfort – especially reduced bulk – and reduced total weight.

"During the month of June, 1968, two VA-86 pilots were forced to eject from their A-7s over water and used the LPA-1 successfully," the squadron commanding officer wrote. "These two instances are the first we have heard of in which the LPA-1 has been used in an actual survival situation. In both instances the equipment worked as advertised. Each pilot reported that the device kept him comfortably afloat in a face-up attitude while wearing full combat flight equipment and in no way restricted his movement in the water or in life raft entry. VA-86 pilots wear the LPA-1 attached to the survival vest rather than attached to the standard torso harness."

The *Blue Hawks* of VA-72 recently ran their own unofficial tests of the LPA-1 consisting of torso hang, open Mediterranean swim and helo pickup to see what

Although the pilot in these two photos tries to float face down, the inflated LPA-1 does its thing and with no action on his part, rights him.

A VA-72 pilot feigns unconsciousness but his LPA-1 keeps him afloat.

the preservers would do before there might be occasion to find out the hard way.

(Before you readers deluge the editor with letters about the helmets in the accompanying pictures, the two VA-72 pilots shown in the water wore the standard flight deck protective helmets to save their own APH hard hats since no surveyed helmets were available.)

Evaluation Swim

VA-72 says their two-man evaluation swim was a "complete success."

"Both pilots found they were able to use all swimming strokes with relative ease," the squadron reports. "When completely relaxed they were supported in a semi-sitting position. No effort is necessary to maintain a full head and shoulders out of the water position. Even if you are unable to see the optional equipment pouches, you can locate them readily and open them easily. One pilot wore the SV-2A survival vest and by back-stretching could easily spot the equipment pouches on the preserver and their contents.

"The helo rescue by HC-2 went without a hitch. The three-pronged seat was dropped to the first pilot. Even with the large flotation lobes in front of him he could easily wrap both arms around the seat centerpost for security. The second pilot, now feigning unconsciousness, was assisted by the helo crewman. The crewman had no difficulty finding the hoist D-ring under the collar lobe and attaching the cable to it. Ascent to the helo was comfortable with the collar lobe acting as a buffer between the hoisting cable and the pilot's face.

"The *Blue Hawks* are most pleased with their new LPA-1 preserver," the squadron report concludes. "We have investigated the change, found it to our liking and wear the new equipment proudly."

(Our thanks to LCDR F. H. Duffield, Jr., now with VA-44, and PH3 T. S. Irving for photos of VA-72's tests. – Ed.) ◄

And away we go! The "survivor" grasps the three-prong rescue seat, his arms around the centerpost and the front lobes of the LPA-1. VA-72 reported that the need for visors down for improved vision in those [illegible] the rotor wash created during their helo pickups.

notes from your flight surgeon

Safety Shoe Save

NAS Chase Field – During fueling operations, a pressure fueling nozzle disconnected and fell, striking an ADJAN on his safety shoe. The extent of the damage done was a two-inch split in the leather toe of the shoe. Once again safety shoes prevented a painful and perhaps serious foot injury.

Helo Hazard

IF YOU ever find yourself a candidate for an on-land helicopter rescue, make sure that your parachute does not pose a threat to your chopper friends. This happened in a recent in-country rescue of an A-7A pilot. Using his survival radio, he directed the helo in to his position but, during the process, realized to his consternation that the helo was coming in over his abandoned parachute. He quickly warned the helo pilot to get clear and the *Jolly Green* moved off. A successful pickup was subsequently made.

The A-7A pilot summarizes our point here: "I should have secured my parachute or moved it away to prevent a possible hazard to the helo."

Flight Boot Save

DURING ejection, an A-7B pilot's feet struck a bar below the forward console in spite of proper positioning of his feet on the rudder pedals. His steel-toed boots prevented severe and possibly disabling injury to his feet. Damage to the boots evidenced forces sufficient to have caused fractures and possible amputations if his feet had not been protected.

Another flight boot save!

Visor Save

THE LEFT internal M-60 machine gun of a UH-1E malfunctioned in flight, resulting in the explosion of a round. The gunner's face and neck were showered with metal particles but his lowered helmet visor minimized injury.

All aircrew members should be advised of the need for wearing the protective visor on the helmet *down.*

Debit and Credit

THE co-pilot of a CH-53A was flying with the sleeves of his nomex flight suit rolled up. The helo crashed and burned. During his escape, as he crawled out of the wreckage, he sustained second degree burns of both arms. We can't say with certainty that having his sleeves rolled down would have prevented arm burns entirely in this case but it could have reduced their severity. On the credit side of the ledger, he *was* wearing gloves and his hands were *not* burned.

Another Visor Save

ON AN authorized low level navigation and bombing training flight, an A-4B descending along a ridge contacted two 100 foot half-inch steel static lines stretched between towers. Although the windshield shattered, the pilot was uninjured except for superficial scratches on his right cheek below the area of the helmet visor. The lower right corner of the visor was broken off and the visor was fractured in several areas. Investigators stated that flying with his helmet visor down saved the pilot from possible serious injuries.

No Signal

TIME was lost in the helo rescue of a downed RF-8G pilot because he thought he did not have any day smoke signals. There were two signals – as required – in the lower container of his RSSK (rigid seat survival kit) which was attached to his inflated liferaft by a lanyard.

After the SAR helicopter picked up a DF steer from the survivor's PRC-90 beeper, he radioed that he could see the helo some 10 miles away. At this time the helo pilot asked for a day smoke signal to localize the survivor's position. The survivor replied that he did not have any and fired a pencil flare which went unseen. Then in answer to the helo pilot's request, he vectored the helo toward him. With another beeper cut, the helo headed for his area. When the survivor fired another pencil flare he was spotted in his raft. Rescue followed.

The helo copilot estimates that the survivor could have speeded up the rescue by about 10 minutes if he had ignited a day smoke signal from his RSSK when requested.

This particular ejection was a controlled ejection off the coast of Vietnam due to flameout of unknown cause. The pilot was able to contact the ship and broadcast a Mayday and a position report before he pulled the face curtain at 10,000 feet. "If" and "might" are sometimes overworked words so we won't detail what could have happened here under slightly different circumstances. The advantages of saving all the time possible in any rescue by making use of all available locator and signaling equipment are pretty obvious.

For a refresher on the contents of the lower container of the RSSK, here is a list of the mandatory items. Unless otherwise noted, quantities are one each. Additional items can be added at the local level but none of the items listed here can be deleted.

Survival radio – If stock levels of survival radios of each command dictate the installation and type survival radio used, such will be directed by the area commander.

Mk-13 Mod 0 signal, smoke and illumination, marine (2)
Dye marker (2)
Signaling mirror, Type II
Ground/air emergency code card
Rations
Desalter kit, Mk-2, Type I
Water storage bag, size A
Nylon cord, Type I (50 feet)
Bailing sponge
Shark repellent
Sunburn ointment

The pilot whose experiences are described above was wearing an LPA-1 life preserver without the optional flare and dye marker pouches. (Please refer to Chapter 10, *NavAir 13-1-6.1, Inflatable Survival Equipment Manual*, for detailed information on the LPA-1.) The investigation board in this case recommended that Mk-13 Mod 0 signals be carried on the LPA-1 in addition to those in the RSSK because of (1) the ease of getting to them and (2) for use if the seat pan has been discarded or lost. The board reemphasized that each pilot and crewmember should be familiar with the location of all personal survival equipment and its importance in even the most routine rescue.

Survival Light

DID you know that you can have velcro hook tape cemented to your survival light and velcro pile cemented to your helmet so that in a survival situation you can attach your light to your head and free a hand for more pressing business?

In his recent FAILSAFE report, an aviation physiologist states that few aircrews in his area know about Air Crew Systems Bulletin 150 which outlines this modification. *(FAILSAFE is the acronym for the Fleet Air Introduction/Liaison Survival Aircrew Flight Equipment Program conducted by physiology training units. – Ed.)* Besides telling riggers how to install velcro hook tape and pile on the light and helmet, the bulletin also covers installation of pile on the Mk-2 and the Mk-4 life preservers and the survival vest for survival light stowage.

Greeniegram

THE pilot in his raft was very difficult to see until such time as he used a green dye marker. The dye marker was visible through the haze for up to 5 miles.

Rescue Helo Pilot

Still Another Visor Save

DURING the low level portion of overland flight in a strike exercise launched from a carrier, an A-4C was struck on the starboard windscreen and vertical stabilizer by a large bird. Part of the windscreen entered the cockpit and part exploded outward. Hydraulic lines were severed with resultant loss of both hydraulic systems.

After the mishap, the pilot climbed to 5000 feet and selected the manual flight control disconnect at 270 knots. After lowering the gear by the emergency release system, he conducted a successful slow flight check and diverted to an uneventful landing.

The pilot was flying with his helmet visor down and sustained only a small cut on the neck from flying plexiglass. ◄

HELICOPTER ROTOR BLADE VORTICES

THE ONLY time that helicopter rotor blades can be considered not dangerous is when they are folded. Once spread, even though static, they become dangerous and once they are engaged the hazards of those whirling blades are fantastic – and for many reasons. When rotor blades, attached to fully articulated heads, are first started or are being stopped – low RPM – the blades flap and in gusty wind conditions can flex downward enough, while turning, to chop off a man's head. Once the blades are turning fast enough for centrifugal force to take over and reduce the flapping action, other problems arise – not from the blades themselves but from the hurricane-force winds of the rotor wash and from the vortex cores which stream behind and below those rotor blade tips.

Innumerable mishaps have been caused by rotor wash and rotor vortex cores. (Refer to the article, Rotor Wash Hazards, in the October 1969 issue of APPROACH for some details of 48 mishaps which occurred during the last four fiscal years.) Recently NavSafeCen received two reports which dramatically illustrated these two hazards to life and aircraft. In the first case three aircrewmen were drowned because of the rotor wash of a large helicopter which was attempting their rescue from a bay. The helicopter was not equipped with a hoist and in order to pick the men up the pilot affected a very low hover. The force of the rotor wash "made it impossible to see or breathe," said the lone survivor who was picked up unconscious by a smaller helicopter. In the second case a transport crashed on takeoff because of control difficulties caused by the turbulence created by the rotor wash or the vortex cores, or both, of a large helicopter which was landing nearby.

Vortices

The least understood of the many hazards caused by helicopter rotor blades is the vortex core. Fig. 1 shows the similarities between the wingtip vortices of fixed-wing aircraft and the rotor blade tip vortices of helicopters. The vortex cores stream aft of the generating aircraft, setting up two disturbed air masses. These vortex cores are quite strong and may last for several minutes. They create a downdraft in the airspace between them and then, in time, move downward themselves – gradually spreading out and dissipating across the earth's surface. Atmospheric conditions – wind and temperature – play an important part in their dissipation. The vortices will last longer in light winds and high temperatures. The intensity of their turbulence is directly proportional to the size and weight of the aircraft. Just as one expects more turbulence behind an A-5 or P-3 compared to a T-34 or T-28, so the turbulence created by a CH-53 is much greater than that created by a TH-57.

Airport Dangers

Pilots of fixed-wing aircraft on takeoffs and landings and during flight in airport patterns where there is intensive helicopter activity must be alert to the hazards of rotor turbulence. Not only are there dangers *in* the wakes but there are also dangers in flying *between* the vortices. Pilots of light aircraft are particularly susceptible to complete loss of control and in some rare conditions design limits of light planes could be exceeded. Fortunately, however, the destructive forces of these vortices usually dissipate within a minute or two. In a test involving a fixed-wing plane and a helicopter of the same gross weight, a 36 degree-per-second roll was induced in the fixed-wing plane flying 1000 feet behind and 200 feet below the helicopter. The fixed-wing pilot, fully briefed on what to expect, had to use nearly all available lateral control to return his aircraft to level flight. Another test involving these two aircraft was a simulated landing approach using a rate of descent of 250 feet per minute through the wake 1000 feet behind the helicopter. As the fixed-wing plane entered the wake, moderate rolling occurred and the rate of descent increased to 500 fpm. Not too good if you were turning final or just crossing the fence!

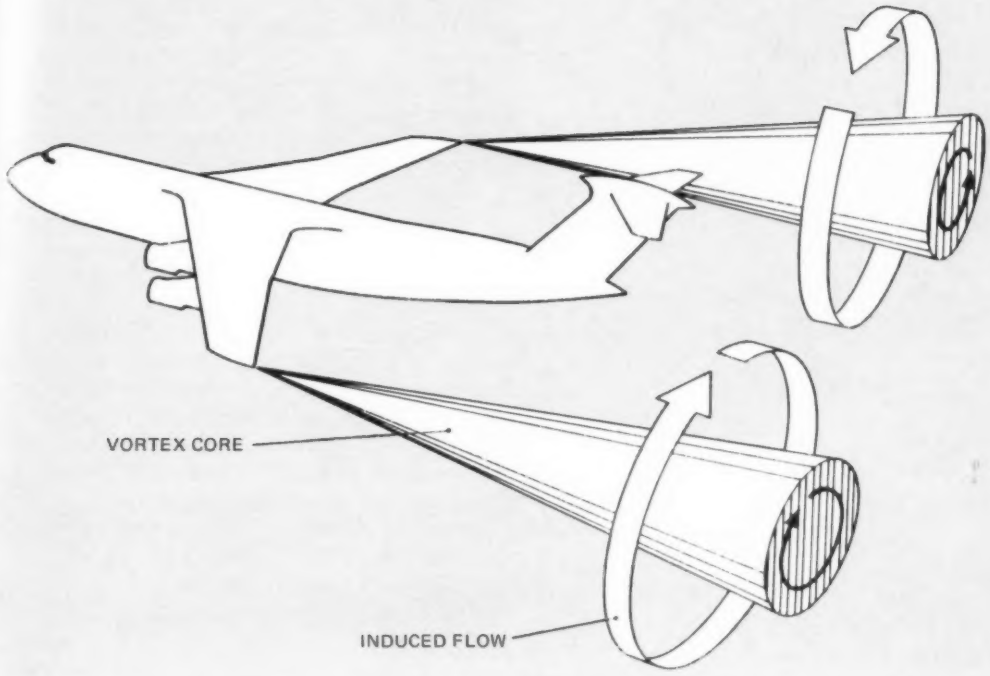
Precautions

In order to minimize the dangers recounted there are several courses of action that tower controllers, helicopter and fixed-wing pilots can take.

Tower operators should exercise appropriate sequencing and spacing of traffic and control of flight paths. Helicopter patterns should be well off to the side of (never across or closely parallel to) duty runways.

Helicopter pilots should carefully plan their flight paths on and around airports, when not under tower control, to avoid hovering or flying closer than 1000 feet upwind of the duty runway and in light wind/no wind conditions, where more than one runway may be used, avoid operating at high thrust within 1000 feet of any runway. Also avoid flying over or within 200 feet of any aircraft.

All pilots (helos too) – should avoid flying in the areas below and behind another aircraft whenever possible. ◄



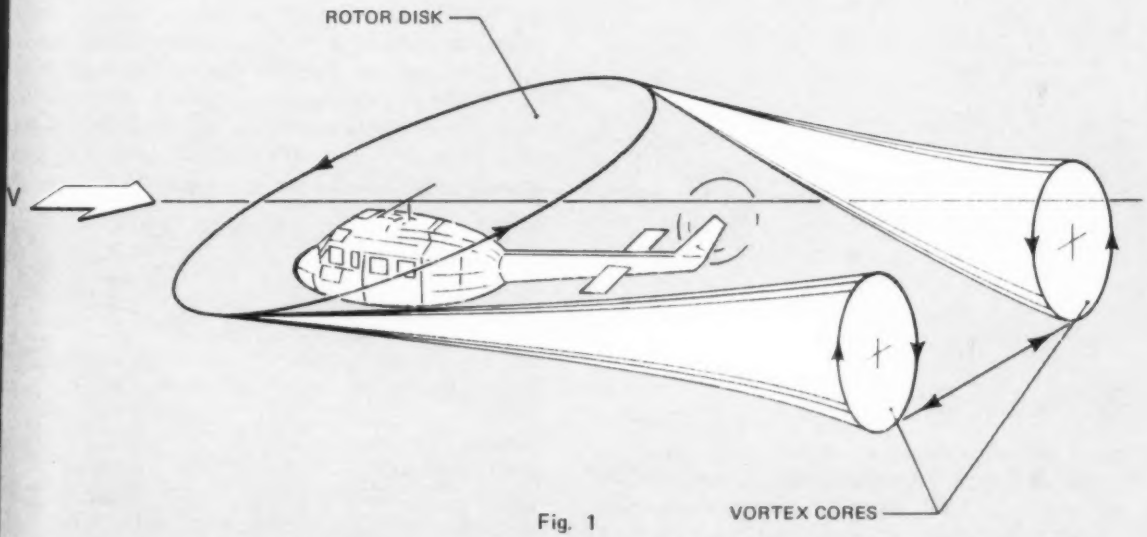


Fig. 1

Information used in this article has been adapted from FDCC TM 67-2, *Helicopter Rotor Wash Effects* by E. H. Flinn, Air Force Flight Dynamics Laboratory.

Simulator Safety

By CDR H. L. Fremd,
Training Analyst, NavSafeCen

OFT/WST (operational flight trainers/weapon system trainers) and cockpit procedures trainers are valuable aids for the initial checkout of pilots *and in the maintenance of flight proficiency*. OFT periods, or even self-imposed cockpit checks, are simply a low cost form of life insurance policy for the proficiency pilot. Still another indication of the value of flight simulators is provided by a recent FAA news release which states, in part:

"After extensive study the FAA has concluded that a pilot trained through the combined use of approved simulators *and* airplanes is a better trained pilot than one trained in airplanes alone." The release adds, "Simulators in many respects, especially visual simulators, provide advantages that airplanes lack, such as allowing the pilot to see and correct for his mistakes without creating possible flight hazards in already congested airspace. FAA now believes that approved simulators can help meet today's more complex training objectives and the greater cockpit demands that can be expected in the future."

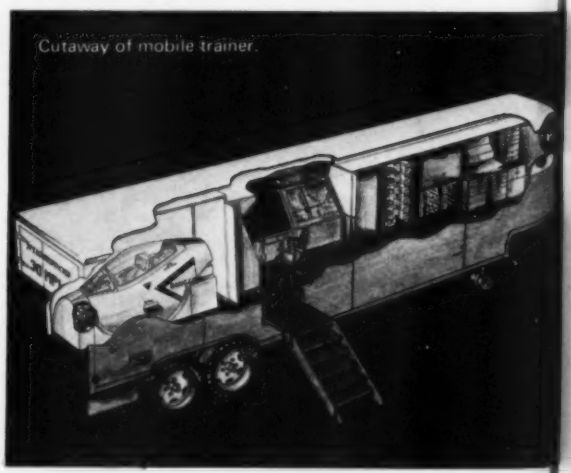
The "future" is already here as far as naval aviation is concerned. Our training objectives are already "complex" – made so by the complexity of modern aircraft and the multiple missions they must perform.

In this context, flight simulators are a relatively economical method for training aircrews in many required functions. This is particularly true where the training objective is the development of motor skills or conditioned responses. The latter aspect is of special benefit in training personnel for emergencies and other safety-of-flight procedures. In the simulator a pilot can perform all of the required procedures including the practice of physical movements which would be necessary during an actual inflight emergency. This is not to say that these procedures cannot also be practiced during actual flight, but there are many procedures involving the physical manipulation of equipment and controls which can be more fully practiced in a simulator. Take an engine fire in flight for example. A pilot in a simulator can go through the step by step procedure for shutting down an engine and manipulating controls in a realistic manner, e.g., physically moving the throttle to CUTOFF if required. Likewise, in practicing for an emergency which would dictate an ejection, he can practice positioning himself correctly and pulling the face curtain. He can really experience the physical movements necessary to get a realistic *feel* in a simulator whereas during such practice while in actual flight he might well be limited to saying to himself (or to his instructor), "If this occurred, I would do this . . . then I would do that . . . " etc. However, no one has yet been able to realistically duplicate in a simulator the tension, pressure and urgency which accompanies many actual flight operations, particularly those involving emergencies.

Most of our NATOPS evaluation programs recognize the role of the flight simulator as a valuable aid in the training of pilots. Typically, an aircraft NATOPS manual will detail a long list of requirements which a pilot must perform in an OFT/WST, cockpit procedures trainer or other simulator during the course of checking out in an aircraft. The TA-4F NATOPS manual, for example, requires that more than 50 different procedures be demonstrated in the OFT/WST.

The Naval Safety Center frequently receives reports of accidents which have been caused or aggravated by a lack of knowledge of either normal or emergency procedures, or both. It is of course problematical as to how many of these accidents could have been prevented by more training in flight simulators.

The point to be made is that flight simulators are not only valuable training aids – but they are here to stay and we should develop a comprehensive, coordinated program to derive the maximum benefit from them. The incorporation of requirements for their use in the various NATOPS manuals is a big step forward but it is just possible that in many cases we are substituting lip service for effective utilization of these devices.



Cutaway of mobile trainer.

Taking out a little insurance.

There is no way to estimate how much, if any, simulator training time has been lost because of ineffective scheduling. But, there is hardly a designated naval aviator alive who has not at one time or another canceled (or even forgotten) a scheduled session in a flight simulator at the last minute without good reason. This is probably more typical of the pilot who is already checked out and is current in model than it is of pilots who are undergoing initial checkouts. This opinion is based on the fact that pilots are most closely supervised during the completion of training requirements for initial checkouts. Moreover, many, if not most, initial checkouts in a particular model aircraft take place in RAG or other training type activities nowadays, where utilization of flight simulators is closely controlled.

One thing is for sure – we must guarantee that training time *is* effectively scheduled. However, the idea is not so much to question hourly use of the flight simulators which are in the inventory as it is to suggest that all hands should get into the act and work actively, positively and with imagination to extract the maximum benefit from this "low cost form of life insurance." One approach to this goal might be to:

- Point out to pilots that the value of OFT/WST and other simulators does not end when the initial checkout in model has been completed. Emphasize that the trainer is the only place where all controls can be manipulated freely during the practice of some procedures. This could be an important point when survival depends on the pilot's ability to perform several checks and several precautionary or corrective actions in a time span measured in seconds.

- Establish and enforce firm scheduling policies at all levels.

- Ensure that a flight simulator program parallel to the NATOPS program exists and is prepared (at least in part) *by* pilots *for* pilots. This would provide a vehicle for collecting and refining training methods which have been proven operationally effective by the *user*.

- As a final point, push not only for more improvement in simulator effectiveness but also tab simulators as an important *planning* consideration at all levels.

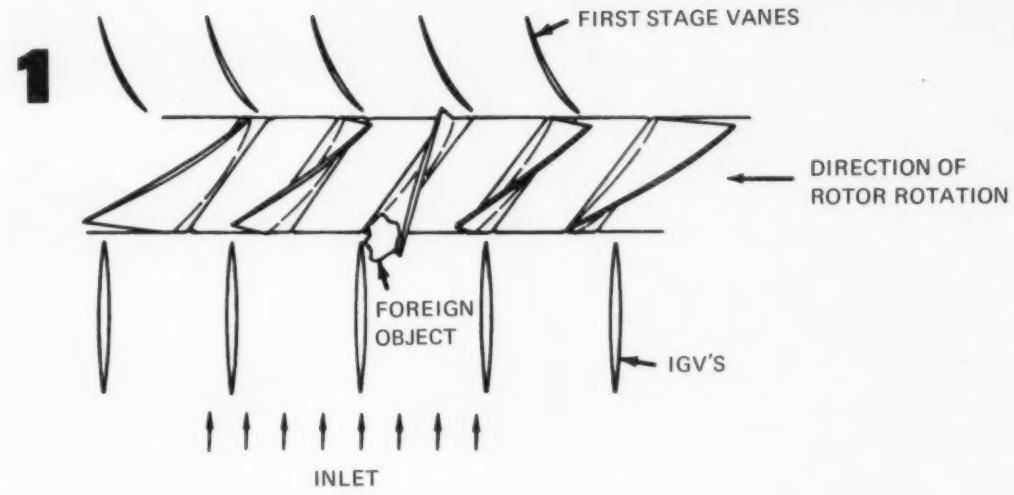
The answer as to how far the development and use of simulators should go will only be answered by time. The important point for now is that as long as accidents occur because pilots did not know or failed to employ correct procedures or knowledge which could have been acquired on the ground, there is still need for more and better utilization of flight simulators and emergency procedures trainers. ◄

T58
Ice Ingestion
FOD
in SH-3s

A FLIGHT of five SH-3As returning from a deployment inadvertently encountered icing conditions. Pieces of ice which built up on the airframes (2 to 3 inches on the center panel of the windshield and sponsons) broke off and entered the engines. Six engines suffered ice ingestion FOD and had to be removed. This was one of many instances that brought about the design and installation of ice shields for H-3 aircraft.

The problem of FOD from ice ingestion in T58 engines installed in H-3 type aircraft has existed for many years – 40 incidents occurred between 1963 and 1968 on various models. Many ideas were tried and discarded in attempts to find a satisfactory fix. Sikorsky submitted an ECP (Engineering Change Proposal) a little over a year ago which NavAirSysCom approved and which resulted in AFC (Airframe Change) 247. This

CH-3C aircraft with inlet deflector installed. Ice/snow buildup on forward section of fuselage and on rotor components constitutes a serious FOD hazard. Photo taken during U.S. Air Force icing tests. Ice fence was installed to prevent entry of dislodged fuselage ice into the engine inlet.



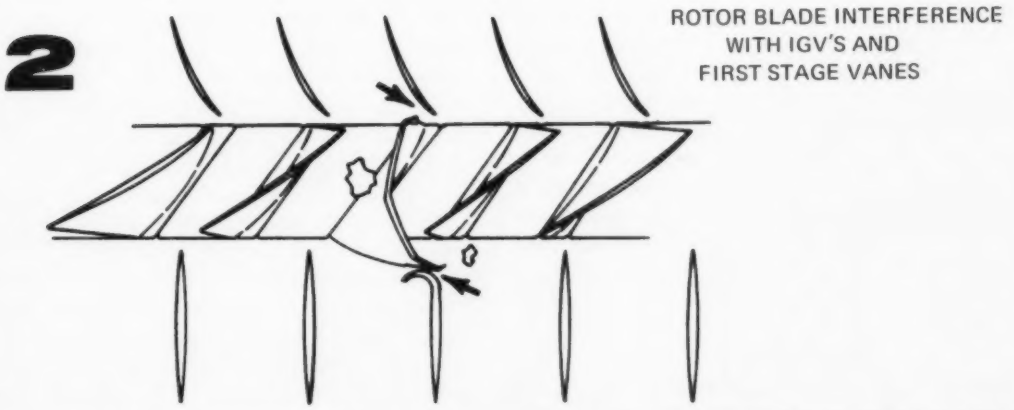


Fig. 1

Impact of foreign object (ice, bird, etc.) on First Stage Blade twists airfoil and deflects leading edge into Inlet Guide Vanes. Rotor Blade trailing edge is frequently twisted rearward into contact with First Stage Vanes. This results in the familiar U-shaped bend and extensive damage to IGV trailing edges.

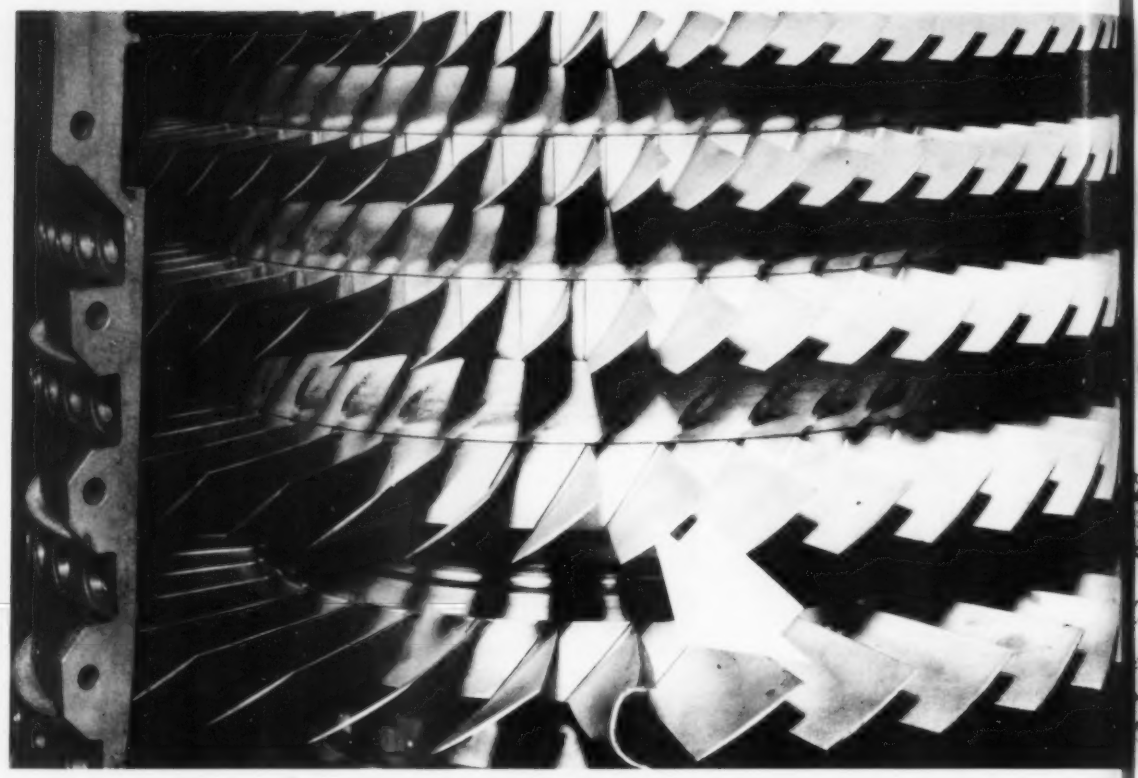


Fig. 2

Compressor rotor damaged by ice ingestion. Note typically U-shaped first stage blade indicative of contact with both IGVs and first stage vanes.

change incorporates an ice/FOD protection shield and has been installed in most Atlantic Fleet H-3 aircraft. Tests have been conducted by one Atlantic squadron flying year-round with the shield installed (including operations in the Caribbean). A reduction of about seven percent in engine performance has been experienced in the SH-3 with the -8 engine and about five percent of the available power is lost with the -10 engine when the shields are used. Plans are underway now to improve the aerodynamic fairings of the shield to improve engine performance without compromising the FOD protection.

Engine Damage

"Compressor damage resulting from ice ingestion is perhaps the easiest type of FOD to identify. The damage is usually confined to one rotor blade or a small sector of first stage rotor blades and occasionally proceeds to the second stage blades but rarely beyond this point. The trailing edges of several IGV (inlet guide vanes) may also show damage, generally corresponding to the same radial location of damage on the rotor blade. Ice is usually broken up sufficiently by contact with first and second stage blades to allow free passage through the remainder of the compressor.

"In the majority of cases, the damaged first stage blades are severely curled and twisted into a U-shape as shown in the photographs. Impact forces cause deflection of the first stage blades forward into the path of the IGVs. IGV contact tends to twist the blade airfoil such that its trailing edge is brought into contact with the first stage vanes. This results in both leading and trailing edges of the damaged rotor blades being bent opposite to the direction of rotor rotation. Rotor blade interference causes IGV trailing edge distortion in the direction of rotor rotation."[1] Typical IGV/first stage blade damage is depicted in Fig. 1 and Fig. 2.

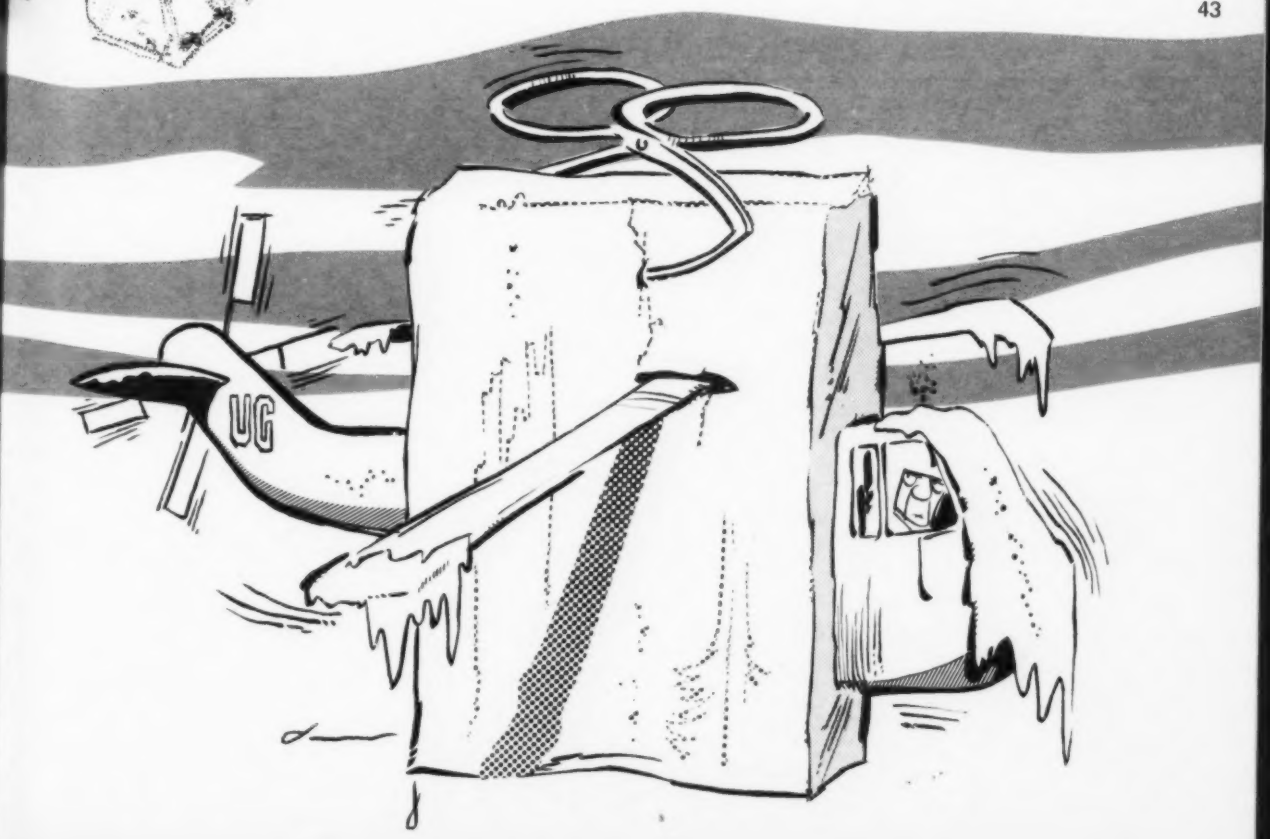
Ice can form in the engine inlet area without forming

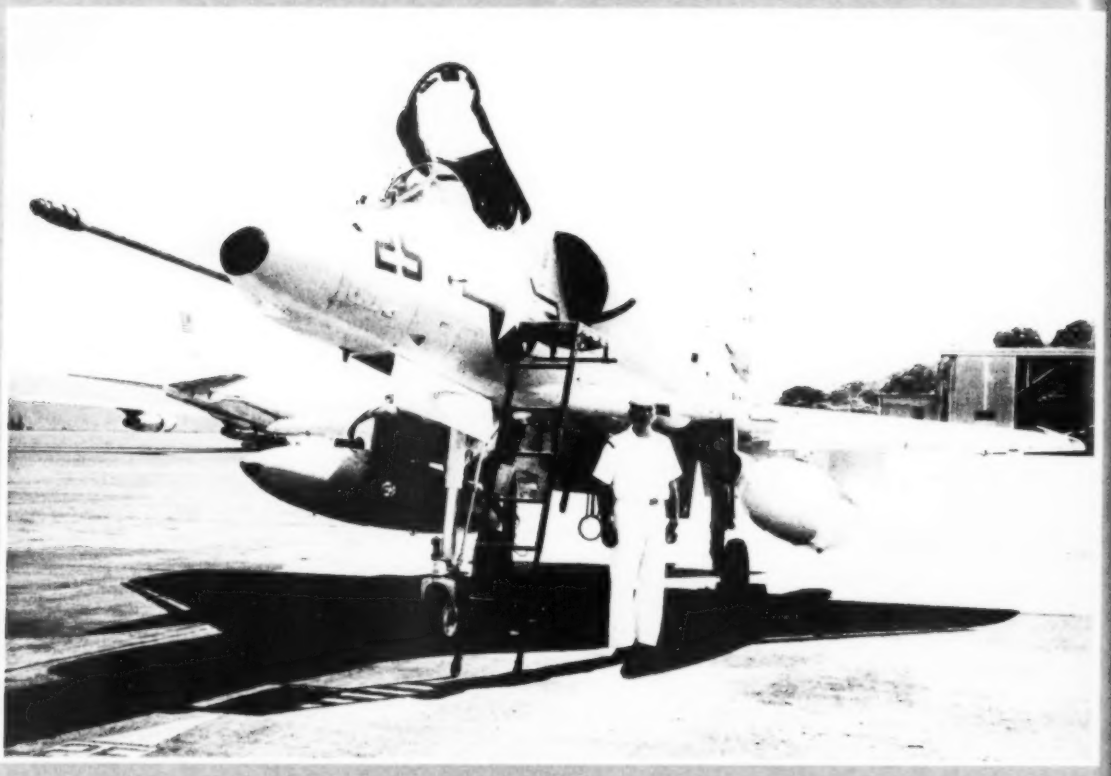
[1] Quoted from the General Electric manual, "T58 Foreign Object Damage, Maintenance and Prevention Guide," Second Edition, Sep 1968. All photographs and the figure used for illustrations in this article were also taken from the same GE manual.

on the airframe. A great many engine changes have occurred because of ice damage to an engine right after start. This is caused by an accumulation of water in low-point areas near the engine inlets which has frozen during a period of aircraft inactivity and is later ingested during a subsequent engine start. Fortunately, damage of this type is usually minor in nature. Manifestation of this damage is usually indicated by compressor stalls.

Caution Still Applies

SH-3 pilots now will have a good chance of getting out of icing conditions, inadvertently entered, with the shield installed without sustaining engine damage. However, lest any SH-3 pilot get the wrong impression, the NATOPS *restriction on flight in known icing conditions still applies.* Two other safety points need to be stressed: the first is that the shield makes visual inspection of the bellmouths and the inlet area of the engines a little more difficult; the second is that the area between the shield and the bellmouths is a convenient place to "temporarily" put tools and rags while working topside and therefore must be carefully checked for "forgotten" material. ◄





Good Show, Petty Officer Nichols!

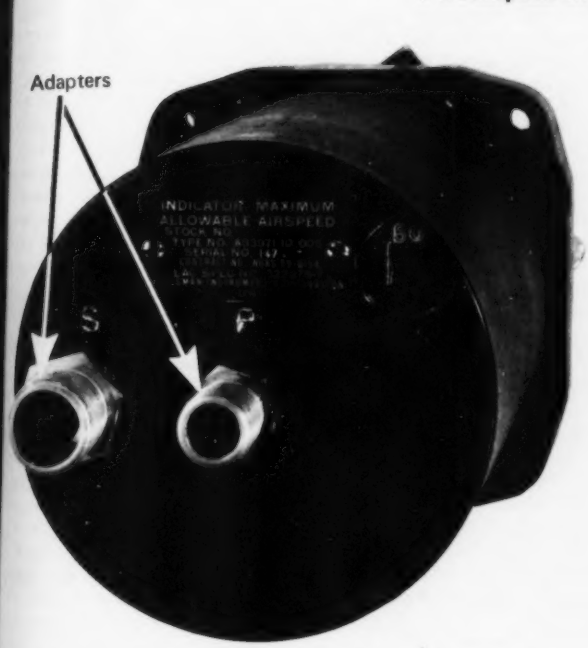
AN UNPREDICTED thunderstorm passed through NAS Cubi Point, Bataan, Republic of the Phillippines about noon time on a mid-summer day, bringing winds with gusts in excess of 45 knots. Six aircraft (four F-8s, one A-4 and one C-1) were parked on a line west of the AIMD hangar, awaiting induction for rework and repair. One of these aircraft, the A-4 *Skyhawk*, weathercocked and started rolling toward the adjacent F-8J. This development was observed by AMS2 Donald E. Nichols who, realizing a collision was imminent, grabbed an aircraft chock from the nearby VC-5 Detachment line, ran to the AIMD line and threw the chock around one wheel of the A-4. His timely action stopped the movement of the A-4 and prevented a ground accident. Nichols called for and received assistance from others in the area and succeeded in securing this and other aircraft without further incident.

The Commanding Officer of NAS Cubi Point commended AMS2 Nichols by letter for "your prompt action and the fine quality of leadership you displayed during the emergency. I extend to you a hearty well done." The Officer-in-Charge of the Cubi Point VC-5 Detachment delivered the letter of commendation with his own congratulations.

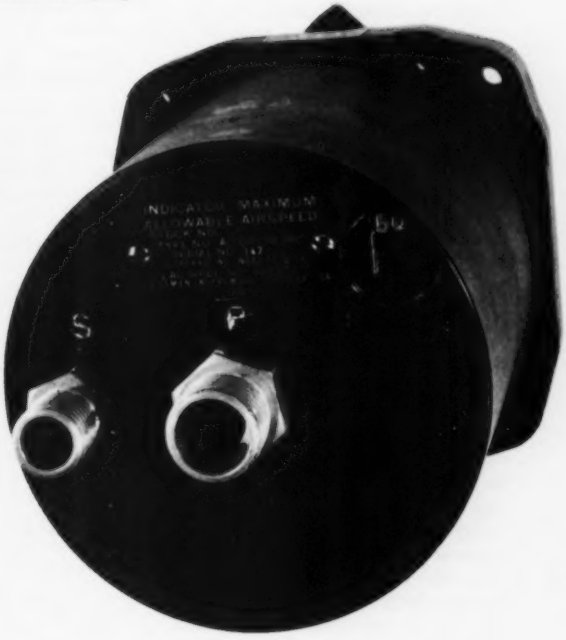
AMS2 Nichol's reaction to this dangerous situation was spontaneous but effective and prevented damage to the A-4, at least one F-8, and quite possibly all six aircraft. Good show, Petty Officer Nichols!

MURPHY'S LAW *

P-3 Airspeed Indicator Murphy



P-3 airspeed indicator with pitot and static line *adapters* incorrectly installed.



P-3 airspeed indicator with pitot and static line *adapters* correctly installed.

THE possibility exists that the pitot and static lines can be incorrectly connected (reversed) to the P-3 airspeed indicator, even though the pitot line has a larger diameter than the static line (see photos). This is possible because the lines are connected to *adapters* which are screwed into the case of the airspeed indicator. That is, the adapters (one for the pitot line and one for the static line) have threads on both ends. The size of the adapter end which mates with the line (pitot or static) will be of the size which will accommodate the line for which it is intended. Since the pitot line is larger than the static line, the connection of the proper line to the proper adapter poses no problem; however, the ends of the adapters which screw into the airspeed indicator case are identical in size, thus creating the possibility that the *adapters* could be reversed during installation if care is not used. Therefore, even though the pitot and static lines may be correctly connected to the proper adapter, the *adapters* may be inadvertently reversed when they are screwed into the instrument case.

General Airframe Bulletin No. 9 of 1 Jul 69 provides for color-coding the pitot and static lines. This, however, does not entirely solve the problem. Therefore, we intend to place a small piece of color tape on the *instrument itself*, next to the adapter fittings to provide for color matching when connecting the lines.

Our thanks to LCDR H. H. Broderson, ASO, VP-49, for this contribution to the war against Murphy — Ed.

* If an aircraft part can be installed incorrectly, someone will install it that way!

Letters

Hovering Over Water

APO, San Francisco – As an Army helicopter pilot in Vietnam I recently came across a problem which is probably common to many Army aviators. During a combat extraction of personnel from a shallow lake I found not only myself but also all the rest of the flight had considerable difficulty in hovering over the water. Much of the difficulty I had was due to rotor wash currents that disoriented me. I would appreciate any tips that you could offer.

WO1 Ralph K. Provident
1st Air Cavalry Div.

● **The best words we can pass along are *practice* and *teamwork*. A low hover over water throws up considerable spray and reduces visibility and distorts definition, thereby making disorientation a real problem for chopper pilots. First, pick out a good, large visual reference point. Then utilize your copilot or crew chief as a director, utilizing either hand signals or voice directions to assist you in reaching and maintaining desired hover position. The following are standard voice directions used by Navy helicopter pilots and crewmen for this purpose. These signals are found in NATOPS, which corresponds to the Dash 10 for the Army.**

The crewman's assistance may be required in directing the aircraft while over the rescue area. He should use the following terminology as required:

1. Forward	Direction of movement – straight ahead.
2. Back	Direction of movement – straight back.
3. Right	Direction of movement – slip to the right, maintain present heading.
4. Left	Direction of movement – slip to the left, maintain present heading.
5. Up	Direction of movement – up collective, maintain relative position.
6. Down	Direction of movement – down collective, maintain relative position.
7. Steady	Hold what you've got, stop movement in all directions.
8. Easy	An indication of rate of movement – precedes the basic command.

Plane is to the left and aft of the pick-up	"Forward ..... Easy" "Right ..... Easy" "Forward ..... Steady"
Plane is even but to the left of the pick-up	"Right . . . . Easy Right . . . . Steady"
Plane is ahead of the pick-up	"Easy Back ..... Steady"
Plane is in a good position	"Steady . . . Steady . . . Steady"

Why Do We Put Up With Murphy?

APO Seattle, Wash. – May a dryshod maintenance technician type who is also a sometime Alaska bush pilot put in an oar here? Reference *Murphy's Law*, on page 44 of the Aug 69 issue. In spite of the cited color coding and the cited single and double ball cable ends on the elevator controls, the TAF-9J control system quick disconnects you pictured seem to me to be begging for just the type of mistake you related.

Why, in the name of simple common sense, isn't this bird equipped with two dissimilar disconnects which simply will not accept the wrong cables? Being in military maintenance myself, I understand the pressure to keep line items to a minimum but it seems that aircraft control cables are one hell of a poor place to practice economy of this nature.

Or, if it be determined that you *must* use identical quick disconnects, what is the feasibility of relocating them . . . say one right and one left from the illustrated spots (I assume this would be one forward and one aft) to points where the incorrect ends of the cable simply will not reach the disconnects and, therefore, cannot be incorrectly installed?

To take your own published definition of Murphy's Law, why, when a Murphy is discovered, don't you take immediate action to redesign the parts so they *cannot* be incorrectly installed?

The automotive industry is full of examples – the old flat head Ford comes immediately to mind – of parts that are designed with off-center keyways, irregular bolt circles, intentional

APPROACH welcomes letters from its readers. All letters should be signed though names will be withheld on request.

Address: APPROACH Editor, Naval Safety Center, NAS Norfolk, Va. 23511. Views expressed are those of the writers and do not imply endorsement by the Naval Safety Center.

dimensional changes and such simple devices to the end that they can only be installed in one way which, of course, is the right way.

Therefore, in my opinion, the fault in the cited incident lies not with the third class metalsmith who incorrectly connected the cables. Instead the fault goes way back to your design acceptance sections with whoever failed to see the potential problem or, seeing it, accepted the design with such a hazardous potential inherent in it. If the problem has been recognized, why in blazes don't you redesign it to where it becomes physically impossible to connect these cables incorrectly? Particularly, since separation of these controls is described as a routine maintenance operation, done by lower echelon personnel.

H. R. McNeal
U.S. Army Tank/Automotive Command
Field Maintenance Technician

• Your thoughtful interest is evident. First, it is appropriate to preface our remarks with the statement that Murphys are reported by individual commands to the *responsible supporting activity* via the UR (Unsatisfactory Report) system, which is a part of the Naval Aviation Maintenance Program. The UR is designed to provide rapid collection of data and dissemination of unsatisfactory material/condition reports to the cognizant governmental and industrial activities responsible for providing prompt correction action. This applies in the case of serious material discrepancies and operational maintenance problems.

This statement is made in order to clarify any misconception which may exist that publication of Murphys in APPROACH constitutes the only action taken. As already stated, Murphy type URs become the subject of official action with the priority and extent of corrective action to be taken depending on many factors. These factors include the degree of hazard involved, the availability of a solution, the time needed to effect a solution, the employment of the aircraft involved and the availability of funds – to name a few. Suffice it to say that such problems are accorded official recognition and corrected as fast as resources permit.

As to the particular Murphy under discussion, the problem was recognized soon after the aircraft was first put into service. (Refer to the Letters Section of the Oct 69 issue which contains amplifying information.) Your letter, while expressing interest in this particular Murphy, seems to be primarily directed at the question of why must we have *any* Murphys? This is difficult to answer and we can only generalize. Ideally, every aircraft part would be so well designed that it would be impossible to install it incorrectly. This ideal, of course, is not a present day reality. This could be due to one or more of the following reasons:

• The Murphy potential may not have been recognized by the designer, the manufacturer or the authorities who accepted the part.

• The part may have been adapted for uses other than that for which it was originally designed.

• The part may have been designed to be used on several different type aircraft (economy).

• The Murphy potential may have been recognized but the accident potential over looked.

• The Murphy/accident potential was recognized but was regarded as a minimal and acceptable risk when weighed against alternatives.

Additional reasons could be stated to account for the present day reality that many parts do have a Murphy potential. This is by no means a defense of Murphy; on the contrary many Murphys are hazardous, indeed, and whenever possible articles are printed in APPROACH to alert personnel concerned. This is done in conjunction with the official actions which are also taking place. In this way we hope to contribute to aviation safety. However the primary long range aim in publicizing Murphys in APPROACH is to encourage designers to design parts that are Murphy-proof and to encourage the development of standards which will preclude acceptance of any part with a Murphy potential. Finally, we seek to emphasize to maintenance and quality assurance personnel that Murphys do exist and are likely to be with us for some time to come. This being so, the only safe course (which we continuously expound) is to provide adequate supervision for inexperienced personnel, use care in the installation of parts and to consult the Maintenance Instruction Manual *every time.* ◄

Please drive carefully; right now the government can't afford to lose even one taxpayer.

FSF Aviation Mechanics Bulletin

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Commander, Naval Safety Center

Our product is safety, our process is education and our profit is measured in the preservation of lives and equipment and increased mission readiness.

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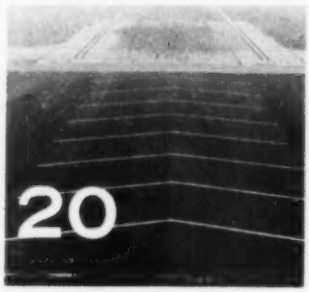

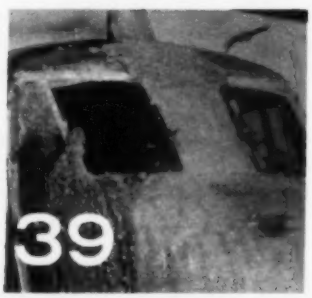

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Credits **Cover painting** by Blake Rader depicts an ASW moment of truth when an S-2E closes in for the kill. **IFC** "Hidden Valley" by Henry C. Pitz, A.N.A. from the Alfred Khouri Memorial Collection, courtesy Norfolk Museum of Arts and Sciences, Norfolk, Va. **Pg 11-13** Diagrams by Don Lips. **Pg 37** Photo courtesy Link Aviation Co. **Pg 40-42** Courtesy GE.

Food for Thought

Safety is by no means an

Accident. It depends upon many

Factors, among which must be:

Experience, Knowledge, Thoroughness,

Teamwork and the most vital of all,

Your own professional attitude.

Contributed by
PRCM G.C. Kikos

UNHAPPINESS IS:

Flying with low-quarter shoes and bailing out into three feet of snow.

Trying to sleep in a noisy BOQ (0300).

Flying at altitude with a fre filled cigarette lighter in y chest pocket.

Landing at NAS Podunk and no place to eat.

adapted from USAF Air Training Command Safety Packet

th a fre
er in y